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A MONOGRAPHIC STUDY OF THE GENUS THYRONECTRIA*

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With five plates

IN THE FAMILY Nectriaceae, of the Hypocreales, is found a small group of species which show many morphological similarities. The most distinctive character possessed by all is the production of muriform septate spores. On the basis of other characters various taxonomists have distributed the species among six genera: *Thyronectria* Sacc., *Pleonectria* Sacc., *Megalonectria* Speg., *Mattirolia* Berl. & Bres., *Thyronectroidea* Seaver, *Pleogibberella* Sacc. But in my judgment they are more properly placed under the two genera, *Thyronectria* and *Pleogibberella*. *Pleogibberella* can reasonably be accepted as defined by Saccardo because the perithecia of its species unlike all the others are blue or violet by transmitted light. Incidentally *Pleogibberella* resembles *Gibberella* except that its spores are muriform.

As a step towards combining the other five, Wollenweber (1928) has already properly reduced *Megalonectria* to synonymy with *Pleonectria*. But all five are so much alike and distinguishable from one another with such uncertainty that there is ample justification for placing all their species under *Thyronectria*, the genus first described. Bringing together this group of about fifteen species greatly simplifies their taxonomic diagnoses.

The genus *Thyronectria* was established by Saccardo in 1875 to include all species of the Nectriaceae with muriform spores. Up to that time they had found a place in the genus *Nectria*. The following year he divided these species between *Thyronectria* and *Pleonectria* gen. nov. on

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a supposed difference in their perithecial stromata. Those with perithecia *immersed* in a stroma, taking *T. patavina* as the type (Pl. 5, fig. 1), were defined as species of *Thyronectria,* those with perithecia discrete or cespitose and *seated* on a stroma were defined as species of *Pleonectria,* with *P. Lamyi* as the type. Saccardo's diagrams clearly indicate the distinction he had in mind when he stated that *Pleonectria* (translating from Latin) "differs from *Thyronectria* almost as *Cucurbitaria* from *Thyridium.*" But more extended observations by Seaver (1909) and myself demonstrate that the variable stromatal character was not clearly understood and therefore that there was not adequate justification for the establishment of the genus *Pleonectria.*

Unfortunately the genus type *Thyronectria patavina* Sacc. is not available, but judging from Saccardo's drawings (Pl. 5, fig. 1) Seaver was correct in feeling that a genus based on it should include all known species, as *T. patavina* did not have a truly Valsa-like stroma with entirely immersed perithecia. Studies by the writer all confirm Seaver's conclusion and indicate that the perithecia of typical "Pleonectrias" such as *T. austro-americana* Seeler while apparently discrete or cespitose on a stroma are always covered by layers of stromatal tissue and often subimmersed to the extent of the *Thyronectria* type *T. patavina* Sacc. and that they are certainly identical in development with *T. Xanthoxyli* (Peck) Ell. & Ev., which has always been considered a true *Thyronectria* with immersed perithecia. In all species the perithecia have a light colored (red, orange, or brown) leathery membranaceous wall typical of the Hypocreales and its degree of fleshiness when wet depends on the thickness of this covering of stromatal tissue.

Another supposed differentiating character on the basis of which certain species of *Thyronectria* might be segregated generically is that of spore color. Thus Berlese and Bresadola claimed that certain species have hyaline spores and that others have dark-colored spores. To accommodate the latter they set up the genus *Mattirolia* in 1889. For what appears to be exactly the same reason Seaver (1909) later created *Thyronectroidea* with *T. chrysogramma* Seaver as the type to be the genus repository of dark-spored members of the group. He did not explain why *Mattirolia* was disregarded in that connection. However, spore color differences, just as is true of stroma differences, are neither constant nor sharply defined. As a matter of fact, the spores of all species of *Thyronectria* are yellowish or pale brown at maturity. According to my experience the variations and the differences in degrees of coloring are not constant enough or sufficiently well-defined to serve for generic distinction. It may further be remarked that even for

Seaver's type species *Thyronectroidea chrysogramma* the wall of the ascospore is dark-colored in the inner layer and hyaline in the outer, which is merely an exaggeration of the condition found in the ascospore walls of other species of *Thyronectria*. Hence both *Mattirolia,* assuming that the spores of its species may properly be defined as muriform, and *Thyronectroidea* should be reduced to synonymy.

Regarding *Mattirolia* there is a disturbing fact to which attention has not heretofore been called and of which mention should be made. According to the clear drawings and descriptions of Berlese and Bresadola (Pl. 5, fig. 2, 3) their two species of *Mattirolia* would differ from Saccardo's definition only by colored spores. So the Berlese and Bresadola species, to judge from the descriptions, might simply be transferred to the present *Thyronectria*. However, examination of the genus type *M. roseo-virens* disturbs that easy conclusion. Part of Bresadola's original collection is in the Farlow Herbarium (ex Patouillard). It is a fungus which fits the description externally but its green spores are only two-celled, finally separating into single-celled units (*Chromocrea* Seaver, Mycologia **2**: 58. 1910), so it must be excluded from the muriform spored group. A final decision cannot be rendered, however, until all of the type collection has been examined, because it is possible that in the part of Bresadola's collection studied by Berlese two distinct fungi may be present. This would seem to be borne out by Berlese's illustrations of gross materials as shown in Plate 5, figure 2. The three illustrations in the upper left corner certainly suggest that they represent a fungus different from the one represented immediately below. If this be true, then the part of the type collection in the Farlow Herbarium does not contain any *Mattirolia roseo-virens* as described by Berlese. All of it happens to be externally like what is shown in the three upper illustrations referred to. Surely Berlese must have seen a fungus in the material studied by him with muriform spores such as he figured and described, and on this assumption I am including translations of his two descriptions and giving these species a place in my key.

Of the four generic names that in my opinion should be regarded as synonyms for *Thyronectria* there remains for discussion the genus *Megalonectria* of Spegazzini, a genus to which so far only one valid species has been referred. Its sole distinction from *Thyronectria* is the possession of a *Stilbella* as the conidial stage, and since the erect coremia are often broken off or lacking in limited collections, some confusion has arisen between the two genera. Its separation on this uncertain basis seems unnatural to the author, as included in *Thyronectria* are species showing imperfect spores enclosed in pycnidia, and other species with

Tubercularia-like sporodochia. An elongation of the cushion base in the latter could easily evolve the Megalonectria-Stilbella structure having the conidiophores on the top of a stalk. As a matter of fact such an extension of the base actually occurred in some of my cultures of *T. austro-americana* resulting in something like a coremium. For these reasons the writer has followed Wollenweber in reducing *Megalonectria* to sub-generic rank and is reserving comment on the commonly accepted separation of *Sphaerostilbe* from *Nectria* on this character alone.

In so doing, however, it is freely acknowledged that study of the life histories of individual species of the fungi must be made before "natural" relationships can be known and as Seaver (1909) and Petch (1938) have pointed out, nowhere is such investigation more necessary than in the Hypocreales, many of whose members have been shown to be economically important in their conidial phase. Until that has been done, however, there are no valid reasons for retaining the genus *Megalonectria,* any more than there is for recognizing *Pleonectria, Mattirolia,* and *Thyronectroidea.* All are better regarded as synonyms of *Thyronectria.*

At this point it is fitting to refer to the conidial fructifications of *Thyronectria.* Fuchs was the first to connect a conidial stage experimentally with a species of *Thyronectria* when he reported four forms of spores developed in the life history of *T. berolinensis*: ascospores, ascoconidia (not in the ascus), microconidia (resembling *Tubercularia vulgaris* Tode), and macroconidia (a species of *Fusarium*), the last only in culture on potatoes. Wollenweber (1931), who later studied this species, denied the production of any Fusarium spores. Next Miss Lieneman (1938), as well as the author, observed the microconidia in the stromata of *T. austro-americana* (*T. denigrata*) for which the name *Gyrostroma austro-americanum* is here suggested, and these were also found to be formed from free hyphae in culture. She also concluded that ascoconidia (myriospores) were sometimes produced in the ascus (an occurrence observed by the writer) under certain conditions of humidity, and that therefore *T. sphaerospora* (Ell. & Ev.) Seaver was a synonym.

The writer has added to this growing list a pycnidial phase for *T. missouriensis,* having grown it in culture, and presents the name *Gyrostroma missouriense* for purposes of convenience in classification. Also observed for the first time are remains of a Gyrostroma stage of *T. balsamea,* and of a Tubercularia sporodochium for *T. antarctica,* although for neither of these was sporulating material available.

To place these new conidial phases in Wollenweber's "key" (1926, p. 184) the following arrangement is offered:

Subgen. 1. **Gyrostromella** Seeler, n. subgen.: stat. conid. *Gyrostroma* Naoumoff referens; conidia continua, minutissima, ovata vel allantoidea.

a. on *Gleditsia* and *Acacia* — North and South America. *Gyrostroma austro-americanum* Seeler [stat. ascig. = *Thyronectria austro-americana* (Speg.) Seeler.]

b. on *Carya* and *Acer* — North America. *G. missouriense* Seeler [stat. ascig. = *T. missouriensis* (Ell. & Ev.) Seaver.]

c. on *Abies* and *Tsuga* — North America. Probably *Gyrostroma* [stat. ascig. = *T. balsamea* (Cke. & Pk.) Seeler.]

Subgen. 2. DENDRODOCHIELLA Wollenweber: stat. conid. *Dendrodochium* Bon. referens; conidia continua, minutissima, cylindracea, recta v. incurva, utrinque rotundata.

a. on *Ribes* — Europe and North America. *Dendrodochium berolinense* Wollenweber [stat. ascig. = *T. berolinensis* (Sacc.) Seaver.]

b. on various hosts — southern South America. Probably *Dendrodochium* [stat. ascig. = *T. antarctica* (Speg.) Seeler.]

Subgen. 3. MEGALONECTRIA (Sacc.) Wollenweber: stat. conid. *Stilbellam* referens; conidia continua, ovata.

a. on various hosts — circum-tropical. *Stilbella cinnabarina* (Mont.) Wollenweber [stat. ascig. = *T. pseudotrichia* (Schw.) Seeler.]

In conclusion of this discussion it should be pointed out here that there are peculiarities of the genus *Thyronectria* which are what might be termed "nectriaceous characters" as contrasted with "sphaeriaceous characters." Besides the light color and soft fleshiness of moist perithecia and stromata there is the lack of true paraphyses. Instead of them there are evanescent branching filaments (pseudoparaphyses) which in the past have been mistaken for paraphyses among the young asci. These grow *downward* from the position later occupied by the ostiole and fill the perithecial cavity before the asci develop and later evanesce leaving the cavity filled with a gelatinous substance. The asci tend to be close-fitting bags around the crowded spores and except in two species (*T. berolinensis* and *T. Lonicerae*) are not specialized for spore discharge by apical thickenings or pores. All the spores have relatively thick and flexible walls made up of an outer envelope and adherent walls of the component cells within; a contrast, for example, with the thin-walled spores in the genus *Cucurbitaria* of the Sphaeriales (see Welch, 1926). These are characters which make the genus a "natural" one as well as one of convenience.

Also to be noted in five of the species of *Thyronectria* is the strong tendency toward the budding of spores within the ascus resulting in the

production of myriads of small hyaline asco-conidia which may in advanced age completely obscure the true ascospores. The misunderstanding of this peculiarity led Saccardo (1878) to establish the genus *Chilonectria* for all "Nectrias" with "myriosporic asci." Now that developmental detail is clear the genus *Chilonectria* is of course no longer tenable and its species migrate into their rightful taxonomic places. In Plate 2, figures 5, 4, 3, 2 and 1, is shown a progression of the budding tendency from *T. berolinensis* (fig. 5) where it occasionally occurs in the perithecium but has not yet been reported within the ascus, to *T. chlorinella, T. balsamea* and *T. Lamyi* (fig. 3, 2, 1) in which budding within the ascus is the normal condition. As stated under *T. austro-americana* (fig. 4) the spores of that species may bud profusely in very damp seasons, but as a rule they do not do so.

As can be seen from the enumeration of species which follows, considerable confusion in classification has arisen because too much stress was laid on the size of stromata and the size of groups of perithecia. Wollenweber (1913) has already stressed these errors. Examination of type specimens and other collections has convinced me that these are characters which depend almost entirely upon the nature of the substratum, in particular the thickness and consistency of the outer bark under which fructifications start and through which they force their way. In the case of *T. austro-americana* the thick bark of the tree trunk causes stromata to be larger in all dimensions and less frequent than does the thin bark of small branches where stromata may be reduced in size and develop in great numbers in close proximity to each other. J. H. Miller (1928) has noted a comparable relationship for *Botryosphaeria Ribis* G. & Dug.

Too critical observance of the color of perithecia induced Speggazini to write descriptions of false species, here placed in synonymy with *T. austro-americana* and *T. antarctica,* since this color depends on the humidity during development and on the weathering of the outer layers of cells.

Observations during my research indicate that criteria for species determination in this group must be: (1) the structure and size of ascospores and their arrangement in young and mature asci, (2) the general appearance of perithecia, such as their size, shape, and color, (3) the structure and color of the stromata, always allowing for relatively slight deviations caused by variations in substratum, in the weather of the growing season and the growth-age of the specimen at hand. The key to species included in this paper is an attempt to follow these principles.

DESCRIPTION OF SPECIES

Thyronectria Saccardo, Grevillea **4**: 21. 1875, genus emend.

Pleonectria Saccardo, Nuovo Giorn. Bot. Ital. **8**: 178. 1876.
Chilonectria Saccardo (in part), Michelia **1**: 270. 1878.
Megalonectria Spegazzini, An. Soc. Cient. Arg. **2**: 216. 1881.
Mattirolia Berlese & Bresadola, Micr. Trid. p. 55. 1889.
Thyronectroidea Seaver, Mycologia **1**: 206. 1909.

Stromata erumpent, superficial or subimmersed, sometimes pulvinate, sometimes reduced to a subiculum, with the perithecia usually in cespitose clusters, usually partly immersed in the stroma, rarely discrete; individual perithecia subglobose, crowded, or collapsing, briefly papillate, rough or smooth, often clothed with a yellowish or greenish coat of scales or powder which may disappear with age leaving the bare wall colored orange, red, brown or very dark but never blue and never carbonaceous; both the stromata and perithecia when moist of a fleshy or leathery texture; asci clavate to cylindrical, mostly eight-spored but not always; ascospores hyaline, yellow or dark brown, many-septate and muriform, without appendages such as setae but in some species budding to form myriads of small hyaline conidia which may completely fill the ascus; filamentous pseudoparaphyses, finally evanescent, no true paraphyses. Conidial phases as far as known belong to the Imperfect genera: *Gyrostroma* Naoumoff, *Dendrodochium* Bonorden (or *Tubercularia* Tode), and *Stilbella* Lindau.

Key to Species

A. Perithecia appearing *free* on the stroma; mature spores hyaline to pale yellow-brown.
  1. Perithecia shades of *red,* darkening; for yellow-orange species see under 2.
    a. Perithecia usually cespitose in groups of *more* than 10; ascospores with very *distinct* transverse and 1–2 longitudinal septa; conidial phase Tubercularia-form. ..... 1. *T. antarctica.*
    b. Perithecia usually in groups of *less* than 10; ascospores with numerous *indistinct* transverse and longitudinal septa.
      (1) Mature perithecia *without* olive-yellow scales; ascospores noticeably *constricted* at the 3 major septa; conidial phase *Stilbella.* ..... 2. *T. pseudotrichia.*
      (2) Mature perithecia mostly *with* olive-yellow scales; ascospores *scarcely constricted;* conidial phase *Gyrostroma.* ..... 3. *T. missouriensis.*
  2. Perithecia *orange* to amber colored, often yellow or green powdered; for gray, drab or dark yellow-brown see under 3.
    a. Asci *2–4-spored,* with ascoconidia.

(1) Ascospores 14–27 × 3–4.5 μ; on *Abies* and *Tsuga*. . . . . 4. *T. balsamea.*

(2) Ascospores soon breaking into rounded muriform segments; on *Ulmus*. . . . . 5. *T. chlorinella.*

b. Asci *8-spored,* usually without ascoconidia.

(1) Ascospores 15–21 × 6.5–8.2 μ; on *Ribes*. . . 6. *T. berolinensis.*

(2) Ascospores 100 × 12 μ; on *leaves* of *Coffea.* 7. *T. coffeicola.*

3. Perithecia *gray,* drab or *dark* yellow-brown.

a. Ascospores 8–16 × 4.5–9 μ; on *Gleditsia* and *Acacia*. . . . . 8. *T. austro-americana.*

b. Ascospores 16–27 × 4.5–7.5 μ.

(1) Ascoconidia present; on *Berberis*. . . . . 9. *T. Lamyi.*

(2) Ascoconidia absent; on *Zanthoxylum* and *Rhus*. . . . . 12. *T. Xanthoxyli.*

B. Perithecia appearing almost *covered* by the stroma.

1. Ascospores *hyaline* to pale yellow-brown at maturity.

a. Asci *cylindrical,* with an apical pore; spores narrowly monostichous; on *Lonicera* and *Symphoricarpos*. . . . . 10. *T. Lonicerae.*

b. Asci *clavate,* without apical pore.

(1) Ascospores *finely* muriform, broadly ellipsoid; on *Acer, Cydonia?, Vitis?*. . . . . 11. *T. pyrrhochlora.*

(2) Ascospores *sparsely* muriform, elongate ellipsoid.

(a) Spores scarcely constricted, 16.4–26.8 × 6–8.2 μ; on *Zanthoxylum,* and *Rhus*. . . . . 12. *T. Xanthoxyli.*

(b) Spores constricted, 25 × 9–11 μ (30 × 8); on *Juglans*. . . . . 13. *T. patavina.*

2. Ascospores distinctly *dark* colored at maturity.

a. Mature spores 22–42 × 11–17 μ; on *Ulmus.* 14. *T. chrysogramma.*

b. Mature spores 18–20 × 10–12 μ; on *Alnus*. . . 15. *T. rhodochlora.*

c. Mature spores 15–18 × 9–11 μ; on *Laburnum.* 16. *T. roseo-virens.*

COMPREHENSIVE HOST AND RANGE KEY

HOST	RANGE	SPECIES
Abies	N. America, (Europe?)	4. *T. balsamea*
Acer	N. America	3. *T. missouriensis*
Acer	Europe	11. *T. pyrrhochlora*
Alnus	Europe	15. *T. rhodochlora*
Berberis	Europe & N. America	9. *T. Lamyi*
Carya	N. America	3. *T. missouriensis*
Coffea (leaves)	Java	7. *T. coffeicola*
Gleditsia	N. & S. America	8. *T. austro-americana*

Host	Range	Species
Juglans (*Cydonia? Vitis?*)	Europe	13. *T. patavina*
Laburnum	Europe	16. *T. roseo-virens*
Lonicera	N. America	10. *T. Lonicerae*
Rhus	N. America	12. *T. Xanthoxyli*
Ribes	Europe & N. America	6. *T. berolinensis*
Symphoricarpos	N. America	10. *T. Lonicerae*
Tsuga	N. America	4. *T. balsamea*
Ulmus	N. America	14. *T. chrysogramma*
Ulmus	N. America	5. *T. chlorinella*
Zanthoxylum	N. America	12. *T. Xanthoxyli*
Various	Circumtropical	2. *T. pseudotrichia*
Various	S. America	1. *T. antarctica*

1. **Thyronectria antarctica** (Speg.), n. comb. PLATE 1, FIG. 1 A–E; PLATE 3, FIG. 8; PLATE 4, FIG. 7.

Pleonectria antarctica Spegazzini, Fungi Fuegiani, p. 104, no. 275. 1887.
Pleonectria vagans Spegazzini, Fungi Fuegiani, p. 104, no. 276. 1887.

Perithecia 250–550 μ diam., mostly 300–350, cespitose in pulvinate clusters of from 3 to 25 or more which measure up to 5 × 3.5 mm., rarely single, not usually collapsing, spherical or laterally crowded, bright red-orange, (Brazil Red*) fading or darkening, usually fleshy with the outer surface cracked, ostiolate papillae obtuse or depressed. Seated on a fleshy pseudoparenchymatous reddish orange stroma which shows what appears to be the remains of a Tubercularia stage; erumpent through outer bark.

Asci loosely clavate, short stiped, 72–120 × 30–38 μ p. sp., finally evanescent.

Pseudoparaphyses pendent from roof of the perithecium, numerous, filamentous, branched, evanescent, no true paraphyses.

Ascospores obliquely uniseriate and much overlapped or irregularly crowded, mostly 8 in each ascus, bluntly terminated cylindrical to broadly fusiform, straight or curved, transversely 6- to 12-septate, mostly 7 to 9, with the septa thick and *distinct* scarcely constricted, and muriform usually by one or two longitudinal divisions, hyaline to pale yellow, 26–41.5 × 9–12.5 μ, commonly 31.5 × 10.5 μ.

TYPE: on dead branches of *Berberis ilicifolia*, Staten Island, Tierra del Fuego, collected by C. Spegazzini, March 1882.

*Names of colors placed within parentheses are those of Ridgway, R. (1912).

RECORDED HOSTS: *Berberis ilicifolia* Forst., *Drymis Winteri* Forst., *Fagus betuloides* Mirb., *Fagus antarctica* Forst., *Maytenus magellanica* Hook.

RECORDED RANGE: Tierra del Fuego; Chile.

SPECIMENS MICROSCOPICALLY EXAMINED: Lent by Museo de la Plata, herb. Speg. no. 1638 *Pleonectria antarctica* (type); Speg. no. 1571 *P. vagans* (type), Isla de los Estados (Staten Island), Tierra del Fuego, and Speg. no. 1639 (co-type) Usuaia, T. del Fuego. In Farlow Herbarium; *P. antarctica*, leg. Thaxter no. 5308, March 1906, Punta Arenas, Chile.

The collection by Roland Thaxter shows in the center of the stroma an elevated naked cushion which may prove to be the remains of a tubercularoid conidial phase. This has been diagrammed in Plate 3, figure 8.

In gross appearance examples of this species showing small stromata might be confused with some specimens of *T. pseudotrichia*. However, the very definite and thick septa of the spores, showing the individual cells in the outer spore envelope will quickly distinguish *T. antarctica*.

2. **Thyronectria pseudotrichia** (Schw.), n. comb. PLATE 1, FIG. 5 A–E; PLATE 3, FIG. 6 A–C; PLATE 4, FIG. 6; PLATE 5, FIG. 5.

Nectria pseudotrichia (Schweinitz sub *Sphaeria*) Berkeley and Curtis, Exotic Fungi from Schweinitz Herb. no. 72, Jour. Acad. Nat. Sci. Phila. **2**: 289, pl. 25, fig. 9. 1853.

Sphaerostilbe pseudotrichia (Schw.) Berkeley & Broome, Jour. Linn. Soc. **14**: 114. 1875.

Sphaerostilbe nigrescens, Kalchbrenner & Cooke, Grevillea **9**: 15, pl. 136, fig. 24. 1880.

Sphaerostilbe rosea Kalchbrenner, Grevillea **9**: 26. 1880.

Pleonectria megalospora Spegazzini, Fung. Argent. **4**: 82, no. 210. 1881; An. Soc. Cient. Argent. **12**: 216. 1881.

Megalonectria pseudotrichia (Schw.) Spegazzini, Fung. Argent. **4**: 82, no. 211. 1881; An. Soc. Cient. Argent. **12**: 216. 1881.

Megalonectria nigrescens (Kalch. & Cke.) Saccardo, Syll. Fung. **2**: 561. 1883.

Megalonectria coespitosa Spegazzini, Fung. Puig. **1**: 160, no. 310. 1889.

Megalonectria verrucosa A. Möller, Phyc. u. Ascom. Bras. p. 298, pl. 4, fig. 55. 1901.

Megalonectria polytrichia (Schw.) Spegazzini var. *australiensis* P. Hennings, Hedwigia **42**: (79). 1903.

Megalonectria madagascariensis P. Hennings, Voeltzkow, Reise Ostafrika **3**: 29, pl. 3, fig. 21. 1908.

Megalonectria Yerbae Spegazzini, Ann. Mus. Nac. Buenos Aires **17**. 129. 1908.

Pleonectria riograndensis Theissen, Broteria **9**: 143, pl. 7, fig. 26. 1910. and Ann. Mycol. **9**: 64, pl. 5, fig. 30, 31, pl. 6, fig. 53. 1911.

?*Pleonectria heveana* Saccardo, Notae Mycol. **24**: 13. Bull. Orto. bot. Napoli. 1918.

Pleonectria pseudotrichia (Schw.) Wollenweber, Angew. Bot. **8**: 195, pl. III, fig. 26. 1926.

Pleonectria caespitosa (Speg.) Wollenweber, Angew. Bot. **8**: 195. 1926.

Perithecia 200–590 μ diam., often about 380 μ, sometimes single or gregarious but usually in cespitose clusters of from 3 to 20 or more erumpent through outer bark, when dry mostly collapsing and pezizoid; outer surface usually cracked and scaly-furfuraceous, sometimes the scales quite verrucose, scales often lacking especially by weathering leaving the perithecia smooth, color essentially bright orange-red (Scarlet) weathering to dark crimson and drab brown finally almost black; ostiolate papillae sometimes visible, usually concolorous occasionally appearing black; stroma rarely pulvinate, usually a subiculum or short stalk under the perithecia and coremia.

Asci when young slender clavate tapering toward apex, later broad closely following contours of the spores, variable stipe slender, finally evanescent, 50–100 × 10–25 μ, average 70 × 18 μ.

Pseudoparaphyses pendent from roof of the perithecium, numerous, filamentous, branched, evanescent, no true paraphyses.

Ascospores obliquely biseriate, closely overlapped, almost always 8 per ascus, broadly bulging ellipsoid sometimes curved and slightly tapered terminally, variable, hyaline to pale yellow or light brown, basically 3-septate and constricted with many other often scarcely discernible transverse and longitudinal septa; 15–40 × 7–15 μ, average 25.5 × 10.5 μ; but some collections averaging over 30 μ long, and freak spores being as long as 54 μ.

Stilbella cinnabarina (Mont.) Wollenweber, Angew. Bot. **8**: 195, 208, pl. 3, fig. 26. 1926. PLATE 3, FIG. 6 B; PLATE 5, FIG. 5 A, D.

Stilbum cinnabarinum Montagne, Ann. Sci. Nat. sér. 2, **8**: 360. 1837.

Stilbum Kalchbrenneri Saccardo, Syll. Fung. **4**: 570. 1886.

Stilbum fusco-cinnabarinum Spegazzini, Fungi Puig. **1**: 160, no. 310. 1889.

Stilbella rosea (Kalchbr.) Weese, Sitz. Acad. Wiss. Wien Math.-Nat. Kl. **128**: 44. 1919.

This is the conidial phase. Coremia single or in groups of 2–6 from a basal subiculum, with or without surrounding perithecia at their bases, orange-red to dark brown at the bases shading about two-thirds up into straw color, 150–300 μ at base sometimes flattened and tapering slightly upward to the globular head which when dry with its mass of straw-colored spores measures 125–500 μ in diam., conidia 4–7 × 2–3 μ.

TYPE: on bark, Surinam, collected by Hering. Herb. Schweinitz.

RECORDED HOSTS: *Acacia horrida* Willd., *Aleuritis moluccanae* Willd., *Cajanus indicus* Spreng., *Celtis Tala* Gill ex Planch., *Eucalyptus* sp., *Gleditsia triacanthos* L., *Hibiscus Rosa-sinensis* L., *Ilex paraguayensis* Hook., *Leucaena glauca* Benth., *Manihot utilissima* Pohl, *Persea gratissima* Gaertn., *Phaseolus lunatus* L., *Pithecellobium dulce* Benth., *Theobroma cacao* L., and bark and wood from numerous unidentified plants.

RECORDED RANGE: Surinam, Brazil, Mexico, Florida (U. S. A.), Cuba, St. Thomas, Jamaica, Porto Rico, Trinidad, British Guiana, Uganda, Madagascar, Ceylon, Sumatra, Java, Philippines, Australia, New Zealand.

SPECIMENS MICROSCOPICALLY EXAMINED: In Farlow Herbarium, as *Megalonectria pseudotrichia,* Cardin 1912, Cuba; Fink 1915, no. 769, Porto Rico; Wight 1909, Jamaica; Thaxter 1913, Trinidad; Theissen 1904, Brazil; D. H. Linder 1923, nos. 65, 252, 548, Trinidad; Bot. Garden, Buitenzorg 1924, Java; Seeler 1939, Florida. *M. madagascariensis,* Hennings, Madagascar (type). *M. nigrescens,* McOwan, Africa?. *M. verrucosa,* Möller, Brazil. *Pleonectria Eucalypti,* Patouillard, Ecuador (unpub'd type). *P. riograndensis,* Theissen, Brazil (type). In New York Botanical Garden; *Pleonectria megalospora,* Stevenson 1916, Porto Rico.

This species is to the tropics and sub-tropics what *Nectria cinnabarina* is to our latitudes — a world-wide form showing little discrimination as to host and varying as much in its appearance. Though the author has not seen all the types, he feels certain that the wide variation within individual collections studied is sufficient to convict temporary environmental changes as the cause for differences which were given specific or varietal significance. Perithecia on one large piece of bark have been seen to vary between the extreme limits of size given. They have exhibited the complete range of stromatal arrangement, of shape, and a color variation from bright red to plain brown (Verona Brown), or nearly black. Possibly the lack of sharply defined weather seasons in some parts of the tropics accounts for this complete developmental series in a single collection.

3. **Thyronectria missouriensis** (Ell. & Ev.) Seaver, Mycologia **1**: 205. 1909. PLATE 1, FIG. 4 A–D; PLATE 3, FIG. 10 A–C; PLATE 4, FIG. 8–9.

Nectria missouriensis Ellis & Everhart, Jour. Myc. **4**: 57. 1888.
Pleonectria missouriensis Saccardo, Syll. Fung. **9**: 990. 1891.

Paranectria missouriensis Rabenhorst-Winter, Fungi europaei no. 3748. 1891.

Perithecia in rounded clusters of 5–50, very rarely single, on a stroma, 300–530 μ diam., mostly about 425 μ, nearly spherical, usually plump at maturity with concolorous ostiolate papillae, collapsing when young, outer surface scaly furfuraceous (the scales Olive-Yellow), or scales lacking and the base-color exposed a dirty orange (Cinnamon-Rufous), young perithecia reddish when dry (Brazil-Red), more orange when wet. Perithecia and stromata absorb water rapidly becoming leathery and somewhat translucent.

Stromata pulvinate, light yellow-orange within, plectenchymatous, erumpent through outer bark or superficial, measuring up to 5 × 3 mm. and 1 to 2 mm. high.

Asci when young tapering for about one third of their length toward the bluntly rounded apex, at first wall is gelatinous and much thicker than at maturity when asci are crowded clavate, loosely surrounding the spores, finally evanescent, flexible in shape, including stipe 90–125 μ by 18–30 μ diam.

Pseudoparaphyses pendent from roof of the perithecium, numerous, filamentous, branched, evanescent, no true paraphyses.

Ascospores 2 to 8 crowded irregularly in ascus, hyaline to pale straw-yellow or in aged specimens loose in perithecium and light brown, ellipsoid to pear-shaped, often tapered toward both ends, occasionally very elongate, muriform, constrictions negligible, septa indistinct, 4 to 20, very irregular in number and angle, 20.9–49.2 × 8.2–14.9 μ, average about 25 × 11 μ.

Gyrostroma missouriense, sp. nov. PLATE 3, FIG. 10 A, B; PLATE 4, FIG. 9.

Pycnidiis loculis irregularibus a summo stromae plectenchymatae, non-ostiolatis, parte exteriore rubroceracea; pycnosporidiis continuis, hyalinis, allantoideis vel rectis, 2.7–3.7 × 0.75–1.3 μ; statu ascogeno *Thyronectriae missouriensis* (Ell. & Ev.) Seaver.

Pycnospores hyaline, one-celled, allantoid or straight 2.7–3.7 × 0.75–1.3 μ, borne on hyphae similar to conidiophores of *Tubercularia vulgaris* but inside irregularly shaped non-ostiolate locules in swellings on upper part of stroma. When dry the swellings look like translucent drops of reddish wax. Later they are pushed aside by the developing perithecia and disappear.

TYPE: on bark of dead *Carya alba* near Concordia, Missouri, March 1888, collected by C. H. Demetrio No. 87.

RECORDED HOSTS: *Carya alba* (L.) K. Koch = *C. tomentosa* (Lam.) Nutt., *Carya* sp., *Acer* (*rubrum*?).

RECORDED RANGE: Eastern half of U. S. A., Maine to Carolinas.

SPECIMENS MICROSCOPICALLY EXAMINED: Demetrio no. 87, 1888, no. 276, 1891, Missouri (type and co-type) on *Carya alba*, in New York Bot. Gard., in Farlow Herb., and in Herb. Patouillard 882: 6742. Rabh.-Wint. Fungi eur. no. 3748, leg. Demetrio, March 1886, Perryville, Mo. In Farlow Herb.: Thaxter, West (New) Haven, Conn., 1888–90, variously labeled "*T. sp.*? *T. pyrrhochlora*?" on *Acer sp.* Thaxter, Kittery Point, Me., 1917–18 on *Carya*. Also specimen collected by D. H. Linder on *Carya sp.*, Kittery Point, Me., Nov. 12, 1939.

Description of the pycnidial phase has not been published heretofore. It has been observed by the author in the type collections by Demetrio, in Thaxter's on *Acer*, and in young stages in Thaxter's and Linder's collections on *Carya* from Maine.

As the ascospores become muriform very early and vary so widely in size in one perithecium, care must be taken not to be led astray by spore appearance in a hasty examination of any meager collection. Though morphologically quite different, this species parallels *T. austro-americana* in all stages of development of stromata and of pycnidial and perithecial phases as has been shown in a comparative study of the two from collected material and in culture.

4. **Thyronectria balsamea** (Cke. & Pk.), n. comb. PLATE 2, FIG. 2 A–G; PLATE 3, FIG. 5 A–B.

Nectria balsamea Cooke & Peck, Ann. Rep. N. Y. State Mus. **26**: 84. 1874; Grevillea **12**: 81. 1884.

?*Chilonectria Cucurbitula* Saccardo (in part), Michelia **1**: 280. 1878.

Calonectria balsamea (Cke. & Pk.) Saccardo, Syll. Fung. **9**: 986. 1891.

Scoleconectria balsamea (Cke. & Pk.) Seaver, Mycologia **1**: 200. 1909.

Pleonectria calonectrioides Wollenweber, Fusaria auto. del. **4**: no. 793, 794. 1930; Zeit. Wiss. Biol. Abt. F, Z, **3**: 493. 1931.

Perithecia 300–425 μ diam., cespitose in pulvinate circular clusters of 2 to 20, usually about 12, which measure 0.6–1.3 × 0.6–1.3 mm., usually collapsed when dry, outer surface cracked into thin scales, usually covered with greenish yellow powder or occasionally with powdery yellow warts, wall base color dark orange (Mars Orange to Burnt Sienna), small ostiolate papillae usually visible only when wet; seated on a deeply fissured orange-colored stroma, erumpent through outer bark.

Asci cylindrical, with slender stipe, apex bluntly rounded, thin walled, 75–120 × 6–10.5 μ, finally evanescent.

Pseudoparaphyses pendent from roof of the perithecium, numerous, filamentous, branched, evanescent, no true paraphyses.

Ascospores variable, uniseriate 1 to 4 in each ascus, mostly 3, elongated ellipsoid or fusoid, somewhat constricted, 3- to 15-septate and irregularly muriform, hyaline 14–27 × 3–4.5 μ, occasionally as short as 7.4 μ and as broad as 5.2 μ, budding very early to form myriads of small, hyaline, one-celled, bacillar ascoconidia, 3–4 × 0.6–1.2 μ, which completely fill the ascus and hide the true ascospores which may finally disintegrate.

There is evidence that the perithecia are preceded on the stroma by irregular pycnidial locules (J. H. Faull no. 6588). Sporulating material of the pycnidial stage has not been available but it will probably fall into the genus *Gyrostroma* Naoumoff.

Type: on dead branches of *Abies balsamea,* North Elba, New York, August 1872. Collected by C. H. Peck.

Recorded Hosts: *Abies balsamea* Mill.; and by Wollenweber, *Tsuga canadensis* (L.) Carr.

Recorded Range: Minnesota to Newfoundland, to New York.

Specimens Microscopically Examined: In Farlow Herbarium, labeled *Chilonectria cucurbitula,* all on *Abies balsamea;* Brainerd, June 1882, Ripton, Vt.; Sept. 1889, Shelburne, N. H.; ex Burt, Dec. 31, 1894, E. Galway, N. Y.; ex Burt, Nov. 3, 1899, Middlebury, Vt.; July 4, 1902, Shelburne, N. H. Coll. & herb. J. H. Faull, on *Abies balsamea,* no. 6588, July 22, 1922, Bear I., L. Timagami, Ontario; no. 9617, Sept. 15, 1930, near Guelph, Ontario, Canada.

Because of an external similarity this species has been confused with *Ophionectria cylindrospora* (Sollm.) Berl. & Vogl. (see Ell. & Ev. N. A. F. 2–1551) which occurs on *Pinus* in Europe and North America, also rarely on *Abies,* and has in each ascus, in addition to the myriospores, two long filiform spores with an indefinite number of transverse but no longitudinal septa. The exact relationship between these two deserves more study, as shown by J. H. Faull's collections from Bear I., Lake Timagami, Ontario, all on *Abies balsamea*: no. 6588 and no. 9617 show the 2–4 muriform spores of *T. balsamea,* while on the other hand no. 5951 and no. 6578 show in each ascus the two long filiform phragmospores of *O. cylindrospora.* Weese in Centralb. f. Bakt. **42**: 596–602. 1914 discusses at length the European synonymy of *O. cylindrospora* including as his var. *tetraspora* the 4-spored phragmosporous *Pleonectria pinicola* Kirschstein.

In No. Amer. Pyreno. p. 116. 1892 Ellis and Everhart included under

the name *Chilonectria cucurbitula* Curr. both species, now called *T. balsamea* and *O. cylindrospora*, and that name has been applied since indiscriminately to many American collections with myriospores on many different hosts. Of course there should be no confusion with *Nectria cucurbitula* (Tode) Fr. which grows on *Pinus* but has eight 2-celled spores and no myriospores in the ascus.

5. **Thyronectria chlorinella** (Cke.), n. comb. PLATE 2, FIG. 3 A–H.

Nectria chlorinella Cooke, Grevillea **11**: 108. 1883.

Calonectria chlorinella (Cke.) Saccardo, Syll. Fung. **2**: 543. 1883; not as in Ellis & Everhart, No. Amer. Pyreno. p. 113. 1892.

Perithecia spherical 250–350 μ diam., discrete or cespitose in groups of 2 to 8, rarely more, amber brown and shiny but normally covered with a heavy coat of bright yellow powder or scales with shining ostiolate papillae protruding, not collapsing, seated on a shallow stroma.

Asci clavate, tapering toward apex, short-stiped, 80–90 × 10–15 μ, finally evanescent.

Pseudoparaphyses pendent from roof of the perithecium, numerous, filamentous, branched, evanescent, no true paraphyses.

Ascospores hyaline, usually 4 in each ascus when young, at first 1- then 3-septate and deeply constricted, soon many-septate and finely muriform, finally separating usually at the three original constrictions into numerous globose or elongated muriform parts, 4.5–8.5 μ diam., which bud myriads of one-celled hyaline ascoconidia, 2–2.5 × 1 μ, filling the ascus.

TYPE: on inner bark of *Ulmus americana*, seaboard of North Carolina, U. S. A. collected by Cooke, April 1881.

RECORDED HOSTS: only *Ulmus americana* L.

RECORDED RANGE: North Carolina and Alabama.

SPECIMENS MICROSCOPICALLY EXAMINED: Ex Herb. Bot. Reg. Kew, H. W. R. 3236, Cooke, No. Car. (type). In Herb. N. Y. Bot. Garden, R. P. Burke, Ala. Sphaer. no. 8, May 1916, Alabama. In Farlow Herbarium, Ravenel, Fungi Amer. Exsicc. no. 736, No. Car. (type).

This description is from type material most kindly sent from Kew Herbarium, which is the same as Ravenel, Fungi Amer. Exsicc. no. 736 much of which is immature and very scanty. It is *not* from Ell. & Ev. No. Amer. Fungi 2–2546 which is *T. Xanthoxyli*, and *not* Ell. & Ev. Fungi Columbiani no. 2006 on *Acer nigrum* collected by Dearness, July 1904, London, Canada, which is a hyalo-phragmosporic sphaeriaceous fungus (*Lasiosphaeria sp.*) and is the same as Dearness' Canadian Fungi "*Nectria chlorinella*" on *Ulmus* and *Tilia* in Farlow Herbarium.

6. **Thyronectria berolinensis** (Sacc.) Seaver, Mycologia **1**: 205. 1909. PLATE 2, FIG. 5 A–F; PLATE 3, FIG. 7; PLATE 4, FIG. 1; PLATE 5, FIG. 4.

Nectria Ribis Niessel, Verh. Nat. Ver. Brünn **2**: 114. 1865. (not *N. Ribis* (Tode) Oudemans, Revis. Champ. Pays Bas **2**: 389. 1897).
Pleonectria Berolinensis Saccardo, Michelia **1**: 123. 1878.
Pleonectria Ribis Karsten, Medd. Soc. Fauna Fl. Fenn. **5**: 42. 1879.
Nectria fenestrata Berkeley & Curtis, Cooke in Grevillea **12**: 81. 1884.
Pleonectria fenestrata (Berk. & Curt.) Berlese & Voglino, in Sacc. Syll. Fung. Addit. 216. 1886.

Perithecia 250–390 μ diam., cespitose in pulvinate clusters of 15 or more, 0.25–3 × 1–10 mm., very rarely single, always collapsing when dry, flattened-spherical and leathery when wet; outer surface cracked with tops of scales smooth or minutely granular, from bright orange color (Orange-Rufous) to dark brown, ostiolate and minutely papillate; seated on a deeply fissured stroma which is yellow-orange within, darker outside, pseudoparenchymatous of angular cells, leathery when wet, erumpent through outer bark.

Asci cylindrical, short-stiped, apex bluntly rounded and slightly thickened and flat on inside with apical pore, wall not noticeably thicker when young, 90–120 × 9–12 μ (Fuchs, 130–185 × 10–12).

Pseudoparaphyses pendent from roof of the perithecium, numerous, filamentous, branched, evanescent, no true paraphyses.

Ascospores uniseriate, mostly 7 to 8 occasionally as few as 2 in each ascus, elongated oval to bluntly terminated cylindrical, mostly straight, 5- to 8-septate, typically 7, and muriform by 1 to 3 divisions, not constricted, hyaline to straw yellow, 15–21 × 6.5–8.2 μ, average 19.5 × 7.5 μ; when loose in the perithecium occasionally budding small unicellular hyaline conidia, a condition not as yet observed within asci.

Dendrodochium berolinense Wollenweber, Zeit. Parasitenkd. **3**: 492. 1931. PLATE 5, FIG. 4 a–c.

Stroma cerebriform or tubercularoid, erumpent, pale yellow to orange-red. Conidia pinkish tawny or pale golden in mass, ovoid-cylindrical, straight or curved, unicellular, 2.7–7 × 1–2 μ, mostly about 3.6 × 1.3 μ, borne at the apices of irregularly or verticillately densely fasciculate branches on the top of the sporodochium.

TYPE: on dead branches of *Ribes aureum* (?), Berlin Botanical Garden, Germany, collected by P. Magnus.

RECORDED HOSTS: *Ribes aureum* Pursh, *R. cereum* Dougl., *R. cognatum* Greene, *R. floridum* L'Herit., *R. klamathense* (Cov.) Standl., *R. lacustre* Poir., *R. longiflorum* Nutt., *R. nigrum* L., *R. Grossularia* L.,

R. rotundifolium Michx., *R. rubrum* L., *R. sativum* Syme, *R. setosum* Lindl., *R. sp.*

RECORDED RANGE: Great Britain, in Europe north to Finland, to eastern Russia, south to Italy. In North America, California (once), Oregon, North Dakota to southern Ontario (Canada), Labrador, New Hampshire, Massachusetts to Maryland, west to Colorado.

SPECIMENS MICROSCOPICALLY EXAMINED: In Farlow Herbarium, Vogel, 1909, Germany; Zimmerman, 1909, Germany; Brenckle no. 261, No. Dak.; University Toronto Herb. no. 3299, Ont., Canada; Darker no. 5593, Ont., Canada; Spalding no. 26, Mich.; Burt, 1909, Vt.; Ellis, Potsdam, N. Y.; Thaxter, Newton, Mass.; Setchell, 1888, Conn.

This and *T. austro-americana* are the only two species of *Thyronectria* which have been proved parasitic. Fuchs (1913) demonstrated experimentally that in the Dendrodochium stage it causes a limited stem canker of cultivated currants in Germany. Wollenweber (1931) denied Fuchs' other contention that there were Fusarium macroconidia produced. The conidial stages have not been available for study here.

7. **Thyronectria coffeicola** (Zimm.), n. comb.

Pleonectria coffeicola A. Zimmermann, Centralblatt f. Bakt., Parasit. u. Infekt. **8**: 118. 1902.

Perithecia superficially seated on a thin almost hyaline stroma, spherical, with an ostiolate papilla, brownish, 350 μ diam. Asci 8-spored, broad. Spores sickle-shaped, blunt on both ends, hyaline, with up to 20 cross-walls and a few longitudinal walls, constricted at the cross-walls, the single cells often showing irregular differences in width, often breaking up into several parts, 100 × 12 μ.

On living leaves of *Coffea liberica* Hiern, in Buitenzorg Botanic Garden.

The above is a direct translation from Zimmermann's German description as cited under the *P. coffeicola* synonym above. This species is included on the basis of the original description, no specimen having been available for study. The extremely long spores and the habitat on living leaves set it apart from all other species of *Thyronectria*.

8. **Thyronectria austro-americana** (Speg.) Seeler, Jour. Arnold Arb. **21**: 405. 1940. PLATE 2, FIG. 4 A–H; PLATE 3, FIG. 11 A–B; PLATE 4, FIG. 10–11.

Pleonectria austro-americana Spegazzini, Fungi Argentini **2**: 27. 1880.
Pleonectria denigrata Winter, Bull. Torrey Bot. Club **10**: 49. 1883.
Pleonectria guaranitica Spegazzini, Fungi Guaranitici **1**: 105. 1883.

Nectria sphaerospora Ellis & Everhart; Bessey & Webber, Ann. Rep. Nebraska State Board Agric. **1889**: 193. 1890.

Chilonectria crinigera Ellis & Everhart, Proc. Phila. Acad. **1890**: 246. 1891.

Pleonectria nigropapillata Starbäck, Arkiv för Botanik **2**: 13, fig. 25–28. 1904.

Thyronectria denigrata (Winter) Seaver, Mycologia **1**: 204. 1909.

Thyronectria sphaerospora (Ell. & Ev.) Seaver, Mycologia **1**: 206. 1909. This was suggested as synonymous with *T. denigrata* by C. Lieneman in Mycologia **30**: 501–509, fig. 46–47. 1938.

Perithecia in rounded clusters, crowded, seated on or embedded in a stroma, 200–450 μ diam., mostly about 280 μ, spherical to top-shaped, not collapsing, outer surface when dry, brittle, finely wrinkled (granulate) yellow-brown or gray, darkening, with dark often black and shining ostiolate papillae. Perithecia absorb water rapidly becoming fleshy to leathery and somewhat translucent.

Stromata pulvinate, fissured, outer cells dark brown, inner light yellow-brown, leathery when wet, compactly plectenchymatous, erumpent (usually) through lenticels of outer bark, measuring up to 12 × 6 and to 3 mm. high depending on the substratum, very rarely on decorticated wood.

Asci when young clavate to cylindrical, thick gelatinous-walled, when mature membranaceous following the contours of the spores, usually short-stiped, 60–110 × 8–19 μ, finally evanescent.

Pseudoparaphyses pendent from roof of the perithecium, numerous, filamentous, branched, evanescent, no true paraphyses.

Ascospores typically 8 in each ascus, uniseriate or irregularly crowded, hyaline at first, finally pale straw yellow, ellipsoid to pear-shaped, unevenly 3- to 6-septate and muriform, divided into 10 to 24 slightly swollen cells, 8–16 × 4.5–9 μ, commonly 12 × 6.5 μ. Occasionally while still in ascus budding to form many ascoconidia or myriospores, a peculiarity which led to the description of a separate species, *T. sphaerospora* (Ell. & Ev.) Seaver.

Gyrostroma austro-americanum, sp. nov. PLATE 3, FIG. 11 A, B.; PLATE 4, FIG. 10.

Pycnidiis loculis irregularibus a summo stromae plectenchymatae pulvinatae, non-ostiolatis, parte exteriore lutescente-brunnea; pycnosporidiis continuis, hyalinis, parvo-ovoideis, 1.8–3.6 × 0.6–1.6 μ, statu ascogeno *Thyronectriae austro-americanae* (Speg.) Seeler.

Pycnospores borne in irregularly shaped cavities in upper part of the stroma and escaping through meandering passages leading to the surface between the perithecia. Before the perithecia mature these passages

terminate in globular or ovoid swellings on the stroma which rupture to exude the spores in orange-yellow "horns." Pycnospores in mass orange-yellow, singly hyaline, ovoid to ellipsoid, one-celled, 1.8–3.6 × 0.6–1.6 μ borne on the tips of clusters of simple or branched slender hyphae within the pycnidial cavity.

TYPE: on *Acacia* sp., Parque de Palerma, Buenos Aires, Argentina, collected by C. Spegazzini — his herb. no. 658. In North America it has been found only on *Gleditsia triacanthos* L. and called *Pleonectria denigrata* Winter or *T. denigrata* (Wint.) Seaver.

RECORDED HOSTS: only as listed under type.

RECORDED RANGE: Brazil, Paraguay and in North America Nebraska to Massachusetts to Florida, and Alabama to Kansas.

SPECIMENS MICROSCOPICALLY EXAMINED: Lent by Museo de la Plata, Herb. Speg: no. 1624 *P. guaranitica* (type) leg. Balansa no. 2759, Aug. 1881, Guarapi, Brazil; no. 1636 *P. denigrata* on *Gleditsia triacanthos* L., Oct. 1905, Buenos Aires, det. Speg.; no. 1640 *P. austro-americana* (co-type), May 1883, Chaco.

In New York Botanical Garden: ex herb. Speg. no. 658 *P. austro-americana* (type), Buenos Aires; ex Balansa Pl. du Paraguay no. 3944 *P. guaranitica* (co-type), Aug. 16, 1883, Guarapi, Paraguay; ex H. J. Webber no. 18 *Chilonectria crinigera* (type), Nov. 1888, Lincoln, Nebraska.

In Farlow Herbarium: Ellis Notebook 4: 65, ex H. J. Webber, no. 18 *Nectria sphaerospora* (type); *P. denigrata* on *Gleditsia triacanthos* as follows: leg. Kellerman, June 1882 (type) which is the same collection as Exsiccati Rabh.-Wint. Fungi eur. no. 2948 and as Ellis N. A. F. no. 1334; Carver, Dec. 1902, Tuskeegee, Ala.; Commons, Oct. 1889, Wilmington, Del.; Fink, Oct. 1918, Union Co., Ind.; Langlois, Feb. 1886, Plaquimines Co., La.; Morgan no. 27, 1896, Preston, Ohio; Seeler, Oct. 1936, Nantucket, Mass., same as Guba, Nantucket Fungi no. 197, and will be issued in Reliquiae Farlowianae. On *Gleditsia japonica* Miq., leg. Seeler, Feb. 1940, Arnold Arboretum, Mass.

The long synonymy for this species indicates its variability under different environmental and substratal conditions. Its life history studied in culture and in the field and a careful comparison of types further prove this and bring to light the constant characters; the structure and context of stromata and perithecia, the small pycnospores in irregular locules, the method of development of asci and ascospores.

No material of *Pleonectria nigropapillata* was available for study but Starbäck's type description and photographs indicate clearly that it should be placed here in synonymy.

It might be well to mention here that *Nectria nigrescens* Cooke, Grevillea **7**: 50. 1879 type on *Gleditsia* from South Carolina had 2-celled spores and so is not synonymous.

Thyronectria austro-americana grows readily in pure culture producing a fine white mycelial mat, micro-conidia after the manner of *Sporotrichum*, pycnidial stromata, and rarely perithecia.

The author has shown this fungus to be the cause of a bark canker of *Gleditsia triacanthos* L. and of a fatal vascular thrombosis of *G. japonica* Miq. — Seeler (1940).

9. **Thyronectria Lamyi** (Desm.), n. comb. PLATE 2, FIG. 1 A–F; PLATE 3, FIG. 9; PLATE 4, FIG. 12.

Sphaeria Lamyi Desmazières, Ann. Sci. Nat. sér. 2, **6**: 246. 1836.
Nectria Lamyi De Notaris, Sphaer. Ital. p. 13, pl. 9. 1863.
Pleonectria Lamyi Saccardo, Mycoth. Venet. no. 688. 1876; Michelia **1**: 324. 1879.

Perithecia spherical to top-shaped, 250–380 μ diam., grouped in multiple rows or as many as 50 cespitose in pulvinate clusters on a deeply fissured, pseudoparenchymatous, usually prominent stroma (sometimes merely a subiculum), outer surface brown (Burnt Sienna) darkening almost to black especially around the ostiolum, often with a furfuraceous coat of olive gray scales.

Asci loosely clavate, of varying shape and size to fit the crowded contents, 100–130 × 12–30 μ, when young thick-walled and gelatinous tapering to a rounded apex.

Pseudoparaphyses pendent from roof of the perithecium, numerous, filamentous, branched, evanescent, no true paraphyses.

Ascospores usually 8 in each ascus, very variable in size and shape, elongated ellipsoid, constricted at the septa, the component cells bulging and often separating, 3- to 9-septate and irregularly muriform, 16–27 × 4.5–7.5 μ, budding on short basidia very many small ascoconidia, 3–3.5 × 0.9–1.1 μ, which soon obscure the true ascospores.

TYPE: on dead branches of *Berberis vulgaris* L., Limoges, France, collected by Lamy.

RECORDED HOSTS: *Berberis vulgaris* L. and *B. sp.*?

RECORDED RANGE: Sweden, Germany, Hungary, western Russia, Italy, France. In North America only the collections of R. F. Cain and H. S. Jackson from Wilcox Lake, Ontario, Canada, University of Toronto Herbarium no. 4167 and no. 6064.

SPECIMENS MICROSCOPICALLY EXAMINED: In N. Y. Bot. Garden, Saccardo Mycoth. Ital. no. 1306, Italy. In Farlow Herbarium, Herb.

Univ. Toronto no. 4167 and no. 6064, Ontario, Canada; Leg. Newadowski, 1912, Russia, ex herb. Bucholtz no. 2014, and ex Theissen. In von Höhnels slides, Kryptogamae exsiccatae no. 822, Hungary, and ex Desm., Nob. pl. crypt. 2 ser. 839. no. 39, France (type).

This species was the basis for Saccardo's genus *Pleonectria* (Mycoth. Ven. no. 688, 1876) because he considered the perithecia to be free and seated on the stroma rather than embedded in it. The author, however, does not believe this distinction valid as the outer covering of the perithecia is stromatic material, and the degree of immersion in the stroma is a variable character within any species.

Thyronectria Lamyi should not be confused with the larger cracked black carbonaceous perithecia of *Cucurbitaria berberidis* (Pers.) Gray, which show thin-walled brown muriform ascospores, and which often occur on the same host branch.

10. **Thyronectria Lonicerae,** sp. nov. PLATE 1, FIG. 3 A–E; PLATE 3, FIG. 2; PLATE 4, FIG. 4, 5.

Peritheciis 250–375 μ diam. subsphaeroidibus, 2–25 laxe vel dense gregariis 0.5–3 × 0.5–2.1 mm., ostiolo prominulo papillato, in stromo prosenchymato fere immersis, membranis (30 μ crassis) muratis, peridermio hospitis elevato, vix erumpentibus, rubro-aurantiis, brunneis.

Ascis cylindraceis, sursum cum foramine parvo immaturis, 100–135 × 9–12 μ (p. sp.), evanescentibus. Pseudoparaphysibus numerosis, filamentosis, decendentibus, ramosis, evanescentibus, paraphysibus veris nullis.

Ascosporidiis oblique monostichis, octosporis, hyalinis vel pallide stramenticie-luteis, elongato-ellipsoideis, muriformiis, regulariter et recte transverse 7-septatis et longitudinaliter sparse divisis, non constrictis, 18–23 × 6.4–7.7 μ.

Hab. in ramis emortuis corticatis *Lonicerae involucratae* Banks, Empire, Colo. leg. Bethel no. 256 et *Symphoricarpi occidentalis* Hook., Northville, S. Dak., leg. Brenckle S. Dak. Fungi no. 1780.

Perithecia 250–375 μ diam., sub-spherical, crowded together in groups of 2 to 25 which measure 0.5–3 × 0.5–2.1 mm., embedded in a shallow light-sand-colored loosely prosenchymatous stroma with only the upper quarter and the short ostiolate papilla protruding and showing the dark red-orange wall color, wall thin (30 μ) distinct, membranaceous, drawing up from below on drying but the top not collapsing, scarcely erumpent through the outer bark.

Asci cylindrical following closely the contours of the spores, short-stiped, when young slightly thickened at the apex with a central pore, 100–135 × 9–12 μ, finally rupturing or evanescent.

Pseudoparaphyses pendent from roof of the perithecium, numerous, filamentous, branched, evanescent, no true paraphyses.

Ascospores obliquely uniseriate scarcely overlapped, typically 8 per ascus, elongated ellipsoid tapering slightly toward both ends, straight or slightly curved, very distinctly and neatly 7-septate and sparsely muriform by one or two discontinuous divisions, 18–23 × 6.4–7.7 μ.

Type: on dead branches of *Lonicera involucrata* Banks, Empire, Colorado, U. S. A., May 22, 1897, collected by E. Bethel no. 256, labeled *T. Patavina,* (in Farlow Herb.); and co-type on *Symphoricarpos occidentalis* Hook., Northville, South Dakota, U. S. A., Jan. 1927, collected by J. F. Brenckle, S. Dak. Fungi no. 1780, determined by Petrak as *T. Xanthoxyli* (in Farlow Herb. and N. Y. Bot. Garden).

The type specimens are the only ones known and examined. This species can be distinguished at a glance through the microscope from *T. pyrrhochlora* and *T. Xanthoxyli* by its long slender asci with an apical pore when young, and by its monostichous smooth spores with neat right angle cross-walls and few longitudinal septa. Its habit sets it apart from other species of *Thyronectria.*

11. **Thyronectria pyrrhochlora** (Auersw.) Saccardo, Michelia **1**: 325. 1878. Plate 2, fig. 7 A–F; Plate 3, fig. 1.

Nectria pyrrhochlora Auerswald, Rabenhorst in Hedwigia **6**: 88. 1869.
Pleonectria pyrrhochlora Winter, Rabh. Krypt. Fl. **12**: 108. 1884.

Perithecia 250–350 μ diam., erumpent through slits in outer bark in double or triple rows of up to 50 (1.5 × 20 mm.), embedded up to the short ostiolate papillae in a light brown plectenchymatous shallow stroma, rarely discrete, not collapsing, wall color (Antique Brown) with a bright (Green-Yellow) powder on upper surface.

Asci cylindrical to clavate, short-stiped, thin-walled, following contours of spores, finally evanescent 67–97 × 17–22 μ.

Pseudoparaphyses pendent from roof of the perithecium, numerous, filamentous, branched, evanescent, no true paraphyses.

Ascospores obliquely uniseriate or upper 4 crowded, typically 6 to 8 in each ascus, short blunt ellipsoid, scarcely constricted, hyaline to pale straw-yellow, transversely 5- to 7-septate and *finely muriform* by numerous thin irregular longitudinal septa, terminal septa radially placed, 15–20 × 7.5–10.5 μ.

See *T. Xanthoxyli* which this externally resembles.

Type: on *Acer campestre,* Arnstad, Germany, collected by Fleischhack.

RECORDED HOSTS: *Acer campestre* L., *Cydonia oblonga* Mill., *Vitis vinifera* L.

RECORDED RANGE: Germany, France, Hungary, Portugal.

SPECIMENS MICROSCOPICALLY EXAMINED: In Farlow Herb.; Rabh. Fungi eur. no. 1234, Germany (type), and in herb. von Höhnel and N. Y. Bot. Garden; Rehm Ascomyceten no. 40, on *Acer campestre*, May 1870, Sugenheim, France, also in herb. von Höhnel and N. Y. Bot. Garden.

12. **Thyronectria Xanthoxyli** (Peck) Ellis & Everhart, No. Amer. Pyreno. p. 92. 1892. PLATE 2, FIG. 6 A–F; PLATE 3, FIG. 4; PLATE 4, FIG. 2.

Valsa Xanthoxyli Peck, Ann. Rep. N. Y. State Mus. **31**: 49. 1879.
Pseudovalsa Xanthoxyli Saccardo, Syll. Fung. **2**: 137. 1883.
Fenestella Xanthoxyli Saccardo, Syll. Fung. **2**: 332. 1883.
Valsonectria virens Harkness in Ellis & Everhart, No. Amer. Fungi 2–1549. 1886.
Thyronectria virens Harkness in Ellis & Everhart, No. Amer. Pyreno. p. 92. 1892.

Perithecia spherical to crowded-ovoid, 250–350 μ in diam., in clusters of from 1 to 25, mostly 4 to 6, which measure 0.6–2 × 0.6–3 mm., not collapsing, embedded (rarely appearing free) in the upper part of a light brown plectenchymatous to pseudoparenchymatous stroma which may be pulvinate or reduced to a subiculum, at first covered with a powdery or furfuraceous yellow-green coat, often with the short dark ostiolate papillae protruding slightly, later darkening by the loss of the yellow powder; actual wall of perithecium dark amber-brown; stroma seated on inner bark and erumpent through the epidermis.

Asci loosely clavate, short-stiped, thin-walled, finally evanescent, 75–105 × 15–23 μ.

Pseudoparaphyses pendent from roof of the perithecium, numerous, filamentous, branched, evanescent, no true paraphyses.

Ascospores crowded biseriate, typically 8 in each ascus, bluntly terminated, ellipsoid, often curved, scarcely constricted, hyaline to pale straw-yellow to light brown, transversely 5- to 8-septate, muriform, 16.4–26.8 × 6–8.2 μ, most collections averaging between 17.5–24 × 7–8 μ.

TYPE: on *Xanthoxylum americanum* Mill., West Troy, New York, collected by C. H. Peck, Oct. 1878.

RECORDED HOSTS: *Zanthoxylum americanum* Mill., *Rhus diversiloba* Torr. & Gray, *Rhus glabra* L., *Rhus typhina* L.

RECORDED RANGE: North America only; California, North Dakota,

Michigan, Ontario (Canada), Ohio, New York, Connecticut, Massachusetts.

Specimens Microscopically Examined: In N. Y. Bot. Garden, *Valsa Xanthoxyli* (type), Peck no. 3402, West Troy, N. Y.; *T. Xanth.*, Stevens, July 1927, Fargo, No. Dak. In Farlow Herbarium, E. & E. N. A. F. 2–1549, *V. virens* (type), leg. Harkness, Sausalito, Calif.; E. & E. N. A. F. 2–2546, *Nectria chlorinella,* leg. Dearness no. 1484, 1890, London, Ontario — also labeled *T. virens.*; E. & E. N. A. F. 2–3310, *T. Xanth.,* leg. Dearness, July 1895, London, Ontario; *T. chlorina,* Thaxter no. 1626, Oct. 7, 1899, Arlington Hts., Mass.; *T. chrysogramma,* Thaxter no. 412, New Haven, Conn.; *T. virens,* Thaxter no. 1631, Mar. 1890, New Haven, Conn.; ex herb. Univ. Ga. no. M 3989 *T. pyrrhochlora,* leg. Miller, Jan. 27, 1926, Athens, Ga.

Seaver (1909) placed this species in synonymy with the European *T. pyrrhochlora* which it resembles externally but from which it differs in that its spores are more slender, slightly longer, and not finely muriform, septa are thicker and transverse septa more regular, perithecia usually show a more prominent dark papilla.

13. **Thyronectria patavina** Saccardo, Fungi Ven. Novi v. Crit. **4**: 23. 1875. Plate 5, fig. 1.

Acervuli Valsa-shaped, scattered, concealed at first by the raised outer-bark, scarcely erumpent; perithecia in a single layer, globoid, ¼–⅓ mm. diam., outside yellow-powdered, context reddening slightly, waxy-membranaceous, subtranslucent; ostioles papillate, very short and most converging, but free; asci cylindrical-clavate, 80–90 × 12 μ, apex rounded, attenuated downwards, thickly and shortly stiped, surrounded by a wall of minutely septate threadlike paraphyses which overtop the asci, 8-spored; spores obliquely monostichous or 2-rowed, oblong, 25 × 9–11 μ, rarely 30 × 8 μ, superficially with small swellings, straight or more often curved, at first full of oil drops, later thinly and profusely 7- to 9-septate, muriform, both very weakly, hyaline; small spores often mixed with the asci are cylindrical, curved 3–4 × 0.5 μ, hyaline.

Habitat on the bark of rotten branches of *Juglans regia* L., associated with *Thyridaria incrustans,* from Padua, Italy, Dec. 1874.

The foregoing is a direct translation of Saccardo's description in Latin. It will be noted that Saccardo describes "paraphyses" for this species. If the structures referred to are of the same nature as corresponding structures in other species of *Thyronectria* they are not true paraphyses, but "pseudoparaphyses" as explained elsewhere in this paper. None of the earlier mycologists distinguished between paraphyses and pseudoparaphyses. This species has not been available for study.

14. **Thyronectria chrysogramma** Ellis & Everhart, Proc. Acad. Nat. Sci. Phila. **1890**: 245. 1891. PLATE 1, FIG. 2 A–D; PLATE 3, FIG. 3; PLATE 4, FIG. 3.

Mattirolia chrysogramma Saccardo, Syll. Fung. **9**: 993. 1891.

Thyronectria virens Harkness var. *chrysogramma* Ellis & Everhart, No. Amer. Pyreno. p. 93. 1892.

Thyronectroidea chrysogramma (Ell. & Ev.) Seaver, Mycologia **1**: 206. 1909.

Perithecia single and nearly spherical or in compact groups of 2 to 13, mostly 3 to 6, and crowded top-shaped, upper one-third bulging but covered up to the necks by stromatal tissue, base embedded, 300–550 μ diam., mostly 380–450 μ, never collapsing, outer surface scaly furfuraceous, bright yellow, darkening, with black shining, protruding ostiolate papillae, leathery when wet.

Stromata, from a thin subiculum to a flat cushion, dirty straw yellow within, outside brownish except where covered by furfuraceous yellow scales, fleshy when wet, plectenchymatous to pseudoparenchymatous, usually about 0.8 mm. long, 1 mm. broad, 1 mm. thick, occasionally slightly larger seated on inner bark, erumpent through the outer bark.

Asci when young tapering toward the apex, walls slightly thicker than at maturity when asci are loose clavate bags surrounding spores, finally evanescent, flexible in shape, about one half the asci with 8 spores and short-stiped, the other asci with from 2 to 8 spores 120–150 × 22–35 μ.

Pseudoparaphyses pendent from roof of the perithecium, numerous, filamentous, branched, evanescent, no true paraphyses.

Ascospores 2 to 8, biseriate or crowded irregularly in the ascus, short ellipsoid with bluntly rounded ends, outer envelope hyaline, inner cell walls very thick and becoming dark brown, 7- to 12-septate, finely muriform, 22–42 × 11–17 μ, average 32.5 μ × 13.5 μ.

No conidial phase has yet been found.

TYPE: on *Ulmus americana* L., Manhattan, Kansas, March 1889, collected by Kellerman and Swingle no. 1421. And co-type on *Ulmus*, Potsdam, New York, 1857, collected by Ellis.

RECORDED HOST: *Ulmus americana* L.

RECORDED RANGE: Ontario (Canada), New York, Missouri, Kansas.

SPECIMENS MICROSCOPICALLY EXAMINED: In Farlow Herbarium, leg. Kellerman and Swingle, Kansas (type); A. P. Morgan no. 21, 1897, Preston, Ohio (co-type); herb. Ellis, leg. Dearness, June 2, 1893, London, Canada (co-type).

This species has been reported on *Ulmus americana* only. In general it differs from other American species of *Thyronectria* in the one feature

of having the inner cell walls of the ascospores thickened and distinctly colored.

15. **Thyronectria rhodochlora** (Mont.), n. comb. PLATE 5, FIG. 3.

Sphaeria rhodochlora, Montagne, Syll. Gen. Spec. Crypt. p. 276, no. 795. 1856.

Mattirolia rhodochlora (Mont.) Berlese, Atti Cong. Bot. Int. Gen. 1892, p. 574, pl. 22, fig. 4, 5. 1893.

Perithecia gregarious or later crowded into a mound but no stroma manifest, superficial (the outer bark having fallen off), covered with light green villose mycelium, globoid, at first rose-colored on sides then brown, provided with a papilla which is first rose then black, ⅓ mm. diam.; asci clavate, 90–100 × 18–22 μ; spores ovoid, often asymmetrical, irregularly transversely 4- to 7-septate, divided into cells by longitudinal septa, at first hyaline then yellowing and finally smoky, 18–20 × 10–12 μ.

Habitat on the bark of dead *Alnus glutinosa* (L.) Gaertn., near Rochecardon, Lyons, France.

Unfortunately, on account of current war conditions, it has not been possible to secure the type material from Europe. It is included, however, for the sake of completeness and the description given is a direct translation from Berlese in the reference cited above.

16. **Thyronectria roseo-virens** (Berl. & Bres.), n. comb. PLATE 5, FIG. 2.

Mattirolia roseo-virens Berlese & Bresadola, Micromyces Tridentini p. 55, no. 110, fig. 3. 1889.

Stromata scattered, covered by the bark, then emerging by breaking through, stretched out or seated on the wood very rarely effused, pulvinate, outside rose or red, disc yellow-green or more or less completely olivaceous, inside pale golden; perithecia more or less stiped, various in size, ovoid or deformed, ostiole obtuse or scarcely prominent, inside completely yellow or (because of mature spores) brown, hollow; asci cylindrical, short-stiped, poorly paraphysate, 110–120 × 15–18 μ, 8-spored; spores irregularly monostichous, ellipsoid, broadly rounded on both ends, very often transversely 3-septate, rarely 5-septate, middle cells or even the end cells divided by a longitudinal septum, 15–18 × 9–11 μ, scarcely constricted, olive-yellow, with small oil drops.

On the bark of branches of *Cytisus Laburnum* L. (now called *Laburnum anagyroides* Med.) near Trent, Italy.

As stated in the introduction there is some confusion surrounding this species because of the fact that a piece of the type collection in the

Farlow Herbarium (Patouillard **884:** 6749) shows green two-celled minutely verrucose spores which separate into single-celled units. These spores would place it in Seaver's genus *Chromocrea* (Mycologia **2:** 58. 1910). Externally the part of the type examined resembles the three sectional drawings by Berlese in the upper left corner of my Plate 5, fig. 2, but *not* the other figures pictured there so clearly. This discrepancy can only be explained when the original material in Italy which inspired these drawings is examined.

For the sake of completing this discussion of muriform spored "Nectrias," it has been assumed that Berlese confused two distinct fungi in the same collection. Therefore *T. roseo-virens* is included here on the basis of the foregoing, translated directly from the type description cited above, and on the basis of the drawings in the lower right part of Plate 5, fig. 2.

DOUBTFUL SPECIES

17. **Thyronectria sambucina** Ellis & Everhart, Bull. Torrey Bot. Club **24:** 458. 1897.

On dead stems of *Sambucus,* Buena Vista, Colo., June 1897 (Bethel, no. 315 a). Perithecia 6–12 in a cortical stroma, globose, about ⅓ mm. diam., brown and coriaceous, their minute papilliform inconspicuous ostiola united in a flat or slightly concave dark brown disk which raises the whitened epidermis into distinct pustules and soon bursts through it; asci cylindrical, p. sp. 130–150 × 18–20 μ; 8-spored, short-stipitate, with abundant but evanescent filiform paraphyses; sporidia uniseriate, oblong-elliptical, about 7-septate, and muriform, slightly constricted in the middle, straw-yellow, 20–25 × 12–14 μ.

In company with *Coryneum sambucinum* Ell. & Ev. and *Tubercularia Sambuci* Cda.

The type in the Farlow Herbarium, Ellis Notebook p. 31, no. 176, does not show any muriform-spored Pyrenomycete, and Mr. J. A. Stevenson reports that after a careful search he and Miss Cash can find no specimen of this species either in the Bethel Herbarium or the U. S. Dept. Agric. collections.

Judged solely on the basis of the foregoing copy of the description, as cited, *T. sambucina* is not synonymous with any other species of *Thyronectria.* Therefore without the support of any valid specimen in the collections of either the authors or of the collector, the status of *T. sambucina* must be regarded as doubtful.

EXCLUDED SPECIES

The following four species names were at one time under the genus *Pleonectria*, but have been correctly reduced to synonymy by the writers cited.

18. **Pleonectria lichenicola** (Crouan) Saccardo, Michelia **1**: 325. 1879.

This is a synonym for *Ciliomyces oropensis* (Cesati) von Höhnel, Sitz. Akad. Wiss. Wien Math.-Nat. Kl. Abt. I, **115**: 672–673, 1 fig. 1906.

19. **Pleonectria appendiculata** Vouaux, Bull. Soc. Myc. France **28**: 193. 1912.

This was reduced to synonymy with *Ciliomyces oropensis* (Cesati) von Höhnel (see no. 18 above) by Weese in Centralb. f. Bakt. **42**: 603–604. 1914.

20. **Pleonectria lutescens** Arnold, Flora **68**: 222. 1885.

This is a synonym for *Xenonectriella lutescens* (Rehm) Weese, Sitz. Akad. Wiss. Wien Math.-Nat. Kl. Abt. I, **128**: 746–750, fig. 1–4. 1919.

21. **Pleonectria pinicola** Kirschstein, Verhandl. Bot. Ver. Prov. Brandenburg **48**: 59. 1907.

This is a synonym for *Ophionectria cylindrospora* (Solm.) Berl. & Vogl. var. *tetraspora* Weese, Centralb. f. Bakt. **42**: 596–602. 1914.

EXPLANATION OF PLATES

Plate 1.

Camera lucida drawings of asci and spores. Spores as seen in an approximately median longitudinal plane.

Fig. 1. *Thyronectria antarctica* (Speg.) Seeler. (A) Mature ascus. × 470. (B) Apex of immature ascus. × 1150. (C–E) Ascospores. × 1150. (A, C, D) are from type material. (B, E) from Thaxter's no. 5308.

Fig. 2. *Thyronectria chrysogramma* Ellis & Everhart. (A) Mature ascus. × 470. (B) Apex of immature ascus. × 1150. (C, D) Ascospores. × 1150. All from type material.

Fig. 3. *Thyronectria Lonicerae* Seeler. (A) Mature ascus. × 470. (B) Apex of immature ascus. Note the apical pore. × 1150. (C–E) Ascospores. × 1150. All from type material.

Fig. 4. *Thyronectria missouriensis* (Ell. & Ev.) Seaver. (A) Mature ascus. Two of the eight spores are drawn with dashed lines behind other spores at the top. × 470. (B) Apex of immature ascus. × 1150. (C, D) Ascospores. × 1150. All from Demetrio's no. 276, a co-type.

Fig. 5. *Thyronectria pseudotrichia* (Schw.) Seeler. (A) Mature ascus. × 470. (B) Apex of immature ascus. × 1150. (C–E) Ascospores. × 1150. All from Thaxter's Trinidad collection of 1913.

PLATE 2.

Camera lucida drawings of asci and spores. Spores as seen in an approximately median longitudinal plane.

Fig. 1. *Thyronectria Lamyi* (Desm.) Seeler. (A) Mature ascus containing eight ascospores and crowded with ascoconidia. × 470. (B) Apex of immature ascus. × 1150. (C) Surface view of ascospore budding conidia, crushed from ascus. × 1150. (D) Ascoconidia. × 1150. (E, F) Ascospores without appended conidia. × 1150. (A–E) from Newadowski, 1912. (F) from Univ. Toronto Herb. 6064.

Fig. 2. *Thyronectria balsamea* (Cke. & Pk.) Seeler. (A) Mature ascus containing three ascospores and crowded with ascoconidia. × 470. (B) Surface view of ascospore budding conidia, crushed from ascus. × 1150. (C–G) Ascospores without appended conidia. × 1150. (A, C, E) from Brainerd, Vt. 1882. (B, D, F, G) from J. H. Faull Herb. 9617.

Fig. 3. *Thyronectria chlorinella* (Cke.) Seeler. (A–D) serial stages in development of asci. (A) Immature ascus containing four 2-celled ascospores. × 470. (B) Immature ascus containing four 3–4-celled ascospores. × 470. (C) Immature ascus containing four ascospores deeply constricted at the original septa depicted in B, and showing other vague transverse and longitudinal septa. × 470. (D) Mature ascus containing the parts of the four original spores and crowded with ascoconidia. × 470. (E) Surface view of ascospore fragment budding conidia, crushed from ascus. × 1150. (F) Ascoconidia. × 1150. (G–H) Ascospore fragments without appended conidia. × 1150. (A–C) from Burke, Ala. Sphaer. 8. (D–H) from type.

Fig. 4. *Thyronectria austro-americana* (Speg.) Seeler. (A) Mature ascus. × 470. (B) Apex of immature ascus. × 1150. (C–F) Ascospores. × 1150. (G) Pycnospores of Gyrostroma phase. × 1150. (H) Surface view of ascospore producing conidia, crushed from ascus. × 1150. (C, E, F, G) from type. (A, B, D) from the type of *Pleonectria denigrata* Winter. (H) from type of *Nectria sphaerospora* Ell. & Ev.

Fig. 5. *Thyronectria berolinensis* (Sacc.) Seaver. (A) Mature ascus. × 470. (B) Apex of immature ascus. Note the apical pore, × 1150. (C–E) Ascospores. × 1150. (F) Surface view of ascospore budding conidia while loose in perithecium — not within ascus. × 1150. (A, C, D, E) from Univ. Toronto Herb. 3299. (B) from Brenckle 261. (F) from Burt, Vt.

Fig. 6. *Thyronectria Xanthoxyli* (Pk.) Ellis and Everhart. (A) Mature ascus. × 470. (B) Apex of immature ascus. × 1150. (C–F) Ascospores. × 1150. All except (B) are from type. (B) from Thaxter 1626.

Fig. 7. *Thyronectria pyrrhochlora* (Auersw.) Saccardo. (A) Mature ascus. × 470. (B) Apex of immature ascus. × 1150. (C–F) Ascospores. × 1150. All from Rehm, Ascomyceten 40.

Plate 3.

Diagrammatic representation of median vertical sections through the long axis of stromata. Drawn with camera lucida to the scale shown above Fig. 9. × 14.

Fig. 1. *Thyronectria pyrrhochlora* (Auersw.) Saccardo. From type material, Rabenhorst's Fungi eur. no. 1234. Fig. 2. *T. Lonicerae* Seeler. From type material, Bethel no. 256. Fig. 3. *T. chrysogramma* Ellis and Everhart. From Dearness' collection of 1892. Fig. 4. *T. Xanthoxyli* (Pk.) Ellis and Everhart. From Thaxter no. 412. Fig. 5. *T. balsamea* (Cke. & Pk.) Seeler. (A) Pycnidial stroma of Gyrostroma stage. From J. H. Faull Herb. no. 6588. (B) Perithecial stroma. From Burt's collection of 1894. Fig. 6. *T. pseudotrichia* (Schw.) Seeler. (A, C) Perithecial stromata from Thaxter's collection of 1913. (B) Coremium of *Stilbella cinnabarina* (Mont.) Wollwr. from Wright's collection of 1909. Fig. 7. *T. berolinensis* (Sacc.) Seaver. From Brenckle no. 261. Fig. 8. *T. antarctica* (Speg.) Seeler. From Thaxter no. 5308. Note the Tubercularia type of sporodochium to the left of the center. Fig. 9. *T. Lamyi* (Desmz.) Seeler. From Newadowski's 1912 collection ex Bucholtz Herb. no. 2014. Fig. 10. *T. missouriensis* (Ell. & Ev.) Seeler. (A) Pycnidial stroma of *Gyrostroma missouriense* Seeler. From Thaxter no. 1629. (B) Perithecial stroma with remains of Gyrostroma stage on the left. (C) Perithecial stroma showing large thin-walled mature perithecium on the right. (B, C) From Thaxter no. 1625. Fig. 11. *T. austro-americana* (Speg.) Seeler. (A) Pycnidial stroma of *Gyrostroma austro-americanum* Seeler, before development of the perithecia. (B) Perithecial stroma showing remains of Gyrostroma locules close below the perithecia. Both from Seeler's collection of 1936.

Plate 4.

Photographs of external appearance of stromata of several species. All to scale shown to the left of Fig. 9. × 10.

Fig. 1. *Thyronectria berolinensis* (Sacc.) Seaver. Perithecial stroma, from Newadowski's 1912 collection ex herb. Theissen, on *Ribes*. Fig 2. *T. Xanthoxyli* (Pk.) Ellis and Everhart. From Thaxter no. 1626, on *Rhus*. Fig. 3. *T. chrysogramma* Ellis and Everhart. Perithecial stromata, from Dearness' collection of 1892, on *Ulmus*. Fig. 4. *T. Lonicerae* Seeler. Perithecial stroma, from Bethel no. 256, on *Lonicera* (type). Fig. 5. *T. Lonicerae* Seeler. Perithecial stroma, from Brenckle's So. Dak. Fungi no. 1780, on *Symphoricarpos* (co-type). Fig. 6. *T. pseudotrichia* (Schw.) Seeler. Perithecial stromata, from Theissen's collection from Brazil. Fig. 7. *T. antarctica* (Speg.) Seeler. Perithecial stroma, from Thaxter no. 5308, on *Berberis*. Fig. 8. *T. missouriensis* (Ell. & Ev.) Seeler. Perithecial stromata, from Thaxter no. 1625 on *Acer*. Fig. 9. *T. missouriensis* (Ell. & Ev.) Seeler. Pycnidial stroma of *Gyrostroma missouriense* Seeler from Thaxter's collection of April 1917 on *Carya*. Fig. 10. *T. austro-americana* (Speg.) Seeler. Pycnidial stroma showing emerging "ribbons" of pycnospores of *Gyrostroma austro-americanum*

Seeler, from Seeler no. 418. FIG. 11. *T. austro-americana* (Speg.) Seeler. Perithecial stroma, from Seeler's collection of 1936 on *Gleditsia*. FIG. 12. *T. Lamyi* (Desmz.) Seeler. Perithecial stroma. Bark of host twig has been cut away on both sides to afford a clearer view. From Univ. Toronto Herb. no. 4167 on *Berberis*.

PLATE 5.

Photographs of illustrations from the literature.

Fig. 1. *Thyronectria patavina* Saccardo, the genus type. From a drawing by P. A. Saccardo in Fungi Italici Autographice Delineati, Plate 153. 1877. Note: perithecia are only partially embedded and not truly valsoid.

Fig. 2. *Mattirolia roseo-virens* Berlese & Bresadola. From a drawing by A. N. Berlese in Mycromyces Tridentini, Plate 5, fig. 3. 1889.

Fig. 3. *Mattirolia rhodochlora* (Mont.) Berlese. From a drawing by A. N. Berlese in Atti de Congresso Botanico Internazionale di Genova 1892, Plate 22, fig. 4 and 5. 1893.

Fig. 4. *Pleonectria berolinensis* Saccardo. From a drawing by H. W. Wollenweber in Sorauer's Handbuch der Pflanzenkrankheiten (5 ed.) 2 (1), Plate 160. p. 571. 1928. Note the Dendrodochium conidial phase at the top.

Fig. 5. *Pleonectria pseudotrichia* (Schw.) Wollenweber. Note the Stilbella conidiospores at the top. From same source as Fig. 4.

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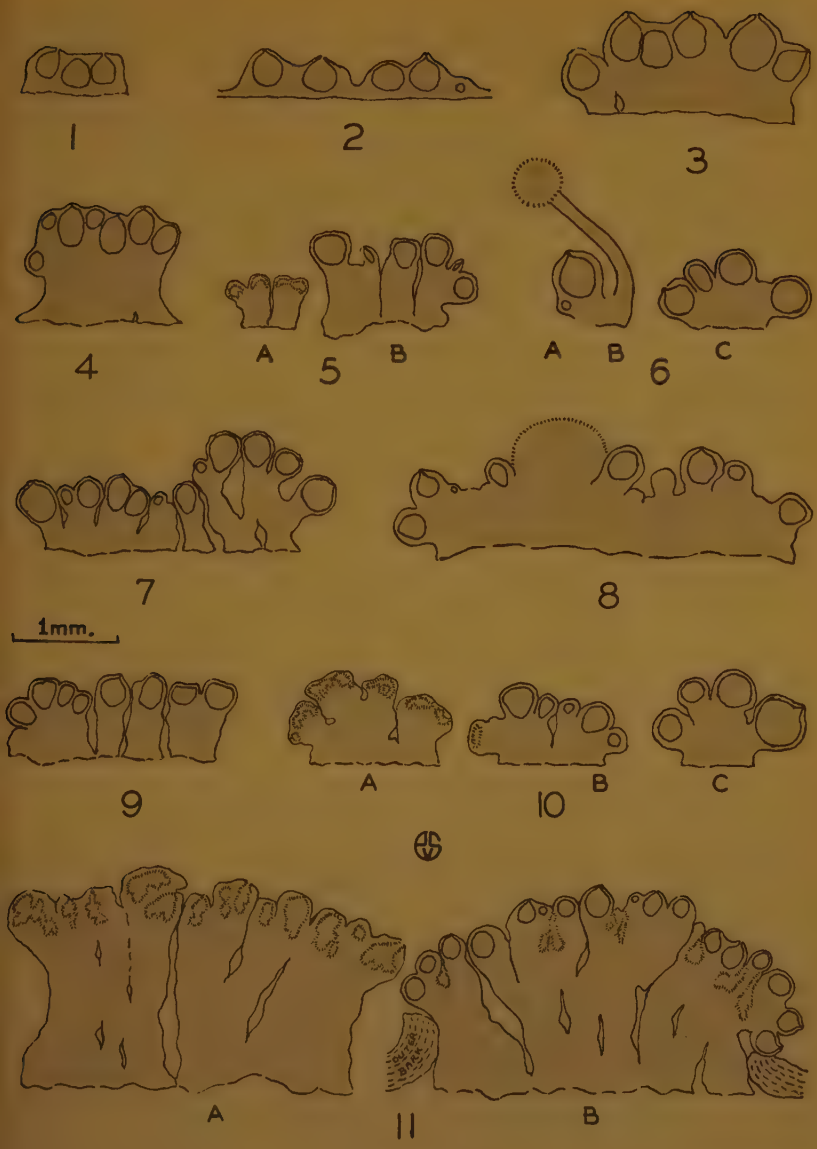

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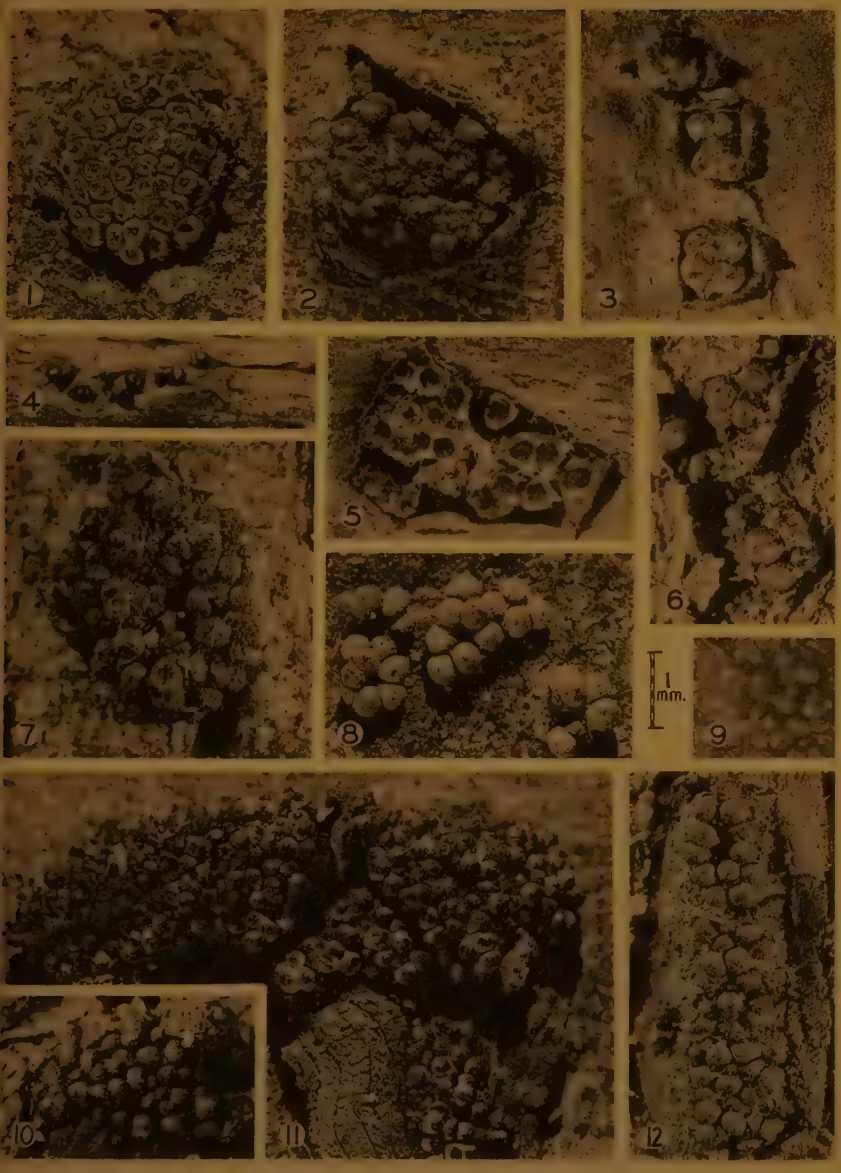

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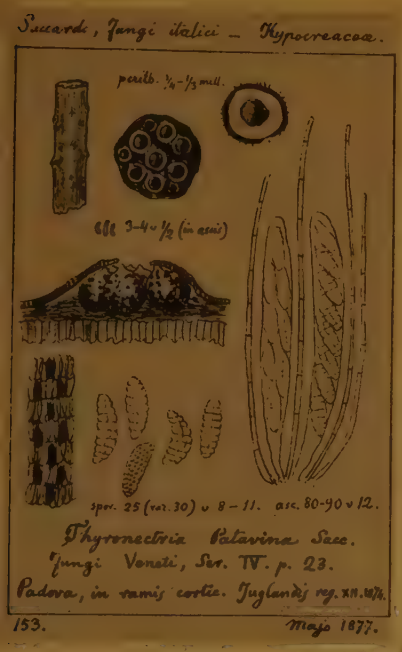

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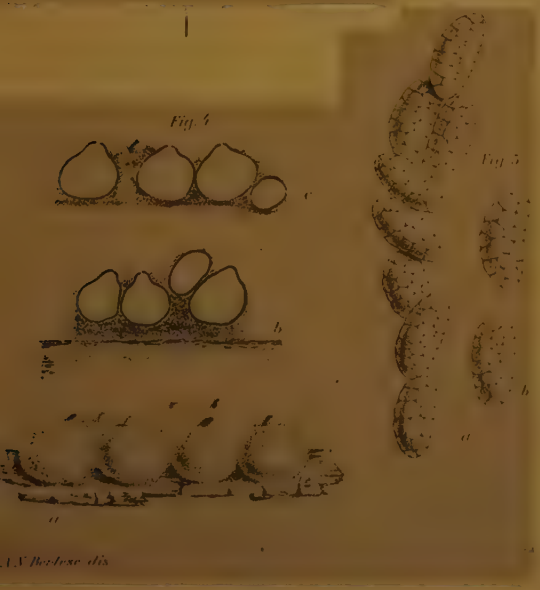

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STUDIES OF THE ICACINACEAE, I

PRELIMINARY TAXONOMIC NOTES

Richard A. Howard

With four plates

Morphological studies of the Icacinaceae are now in progress. These include studies of the wood and twig anatomy, nodal structure, pollen grain variations, as well as the leaf and flower structure. In the present paper I have presented some taxonomic notes required for the proper presentation of some of the anatomical findings which will be published in a following paper.

A taxonomic treatment of this family has long been desirable, since the only comprehensive survey is Valeton's Critisch Overzicht der Olacineae published 54 years ago in 1886. Valeton, agreeing with Bentham and Hooker, treated the Icacinaceae as part of the Olacaceae although Miers had pointed out many years before that these families should be separated. A. Engler prepared the revision for the Natürlichen Pflanzenfamilien in 1893. Since that date little has been published on the family. The present paper is one preliminary to a monographic study of the family.

The author is grateful for specimens generously loaned by the curators of the following herbaria. Arnold Arboretum, Harvard University (A), Field Museum, Chicago (FM), Gray Herbarium, Harvard University (G), New York Botanical Garden (NY), University of California (UC), U. S. National Museum, Washington, D. C. (US).

STEMONURUS Blume

Stemonurus Blume, Bijdr. Flor. Nederl. Indie **13**: 648. 1825, as to generic description; Miers, Ann. Mag. Nat. Hist. ser. II, **10**: 30. 1852, in part; Miers, Contrib. **1**: 80. 1851–61, in part; O. Kuntze, Rev. Gen. **2**: 112. 1891; Engler, Nat. Pflanzenfam. III. **5**: 249. 1893.

Gomphandra Wallich in Roxburgh, Fl. Ind. **2**: 329. 1824, nom., Num. List, no. 3718 (1830), no. 7204 (1832) nom., Wallich ex Lindl. Nat. Syst. ed. 2, 439. 1836; Benth. & Hook. Gen. Pl. **1**: 350. 1862; Val. Crit. Overz. Olac. 207. 1886.

Lasianthera sensu Miq. Fl. Ind. Bat. **1**[1]: 790. 1856, in part; sensu Baillon, Hist. Pl. **5**: 329. 1872, in part; sensu Becc. Mal. **1**: 109. 1877, in part; not Beauv.

Flowers dioecious or possibly polygamous (?), 5- or 4-parted. Calyx short-campanulate, lightly dentate to almost entire. Petals 5 or 4 forming a confluent tube, apices valvate, with inflexed appendages, after anthesis reflexed. Stamens 5 or 4 with filaments fleshy and broad, at the top internally with cavities in which rest the anther sacs, on the shoulder behind the anther sacs and in front and below them, bearing a clavate or barbate pubescence, rarely glabrous, pubescence in the male flowers always exserted after anthesis but included in the female flowers; the anther sacs diverge at the base; stamens hypogynous and free from the petals. In the female flowers the stamens are shorter than the pistil and are sterile. The pistil in the male flowers is small cylindrical to conical and bears an almost obsolete disk at its base, this inferior portion is always solid but the upper portion which is abruptly attenuated may have a single locule with two rudimentary ovules. In the female flowers the pistil is cylindrical to obovate with a glandular, broad, lobed ring at the top, in the sunken center of which is the stigma. The single locule has two pendulous ovules. The disk is absent in the female flowers.

The fruit is a drupe, ellipsoid or oblong to obovoid with a pulviniform, umbilicate, stigmatic, glandular ring persisting, more or less eccentric, the mesocarp is fleshy but evanescent, the putamen is woody and occasionally slightly convex on one side with longitudinal ribs. The single seed is pendulous with a raphe which travels around the fleshy, subbipartite albumen. The embryo is minute and located at the apex of the albumen. The cotyledons are about equal to the length of the radicle.

Trees or shrubs, subglabrous to pubescent, taking various forms. The leaves are alternate, entire, petiolate, exstipulate, subcoriaceous and highly polymorphic. The dioecious flowers are small, articulated in 2–3-chotomized cymes which are few-flowered in the female and with more flowers in the male. The inflorescences are axillary to extra-axillary bearing minute bracts.

TYPE SPECIES: *Stemonurus javanicus* Blume.

DISTRIBUTION: Malaysia to India to the Philippines.

URANDRA THWAITES

Urandra Thwaites, Hook. Kew Jour. Bot. **7**: 211. 1855; O. Kuntze, Rev. Gen. **2**: 113. 1891; Engler, Nat. Pflanzenfam. III. **5**: 248. 1893.

Stemonurus Blume, Bijdr. Flor. Nederl. Indie **13**: 648. 1825, in part, excluding the type; Blume, Mus. Bot. Lugd.-Bat. **1**: 249. 1849, in part; Miers, Ann. Mag. Nat. Hist. ser. II, **10**: 30. 1852, in part; Miers, Contrib. **1**: 80. 1851–61, in part; sensu Val. Crit. Overz. Olac. 230. 1886; not Blume (1825).

Lasianthera sensu Miq. Fl. Ind. Bat. 1^1: 790. 1856, in part; sensu Baillon Hist. Pl. **5**: 329. 1872, in part; not Beauv.

Flowers hermaphroditic. Calyx small, campanulate, 5-toothed or -lobed, persistent. Petals 5, rarely 4, agglutinized into a tube with the sutures evident, apices inflexed, valvate, mid-rib or petal scarcely developed, commonly with vertical lines of dark stained cells, oblong, acuminate.

Stamens 5 rarely 4, hypogynous, alternate with the petals and free from them; filaments fleshy, flattened, at the apex on the dorsal side clothed with long clavate or pilose hairs which are long before aestivation and folded over the top of the stamen, after anthesis these are erect or reflexed, adaxial and below the anthers barbate-pubescent or glabrate, the hairs commonly lanceolate rather than clavate; anther sacs oblong, diverging at the base, erect and adnate by the apex to the top of the connective, dehiscing by a longitudinal slit.

The pistil is ovoid tapering to a conical apex and terminating in a punctiform stigma, surrounded at the base of the ovary by a membranaceous skirt, ovules two, pendant from the apex of the single loculus. Funiculus short.

The drupe is of two colors, usually dark purple below and a lighter color above, ovoid to oblong attenuate at both ends; one-seeded; the mesocarp is fibrous, the putamen almost woody. The seed is pendulous. The minute embryo is in the apex of the fleshy two-parted albumen, the cotyledons usually are much shorter than the radicle.

Trees to shrubs, glabrous, the leaves alternate, simple, entire, exstipulate, coriaceous and thicker than most of the Icacinaceae, pinnately veined. The flowers are articulated, in heads or placed in secund spikes which are umbellate and peduncled. The inflorescences are axillary.

Type species: *Urandra secundiflora* (Bl.) O. Ktze.

Distribution: India, Ceylon, Java, Sumatra, Malay, Borneo, New Guinea and the Philippines.

Key to Stemonurus, Urandra, and some related genera

Flowers perfect.

Pistil ovoid, contracted above the middle to a conical apex, terminating in a punctate stigma, at the base completely surrounded with a membranaceous skirt; fruit narrow-oblong, tapering at each end; leaves thick and coriaceous. Species about 15. Pl. I, figs. 1–6... *Urandra.*

Pistil asymmetrical, at the base developing a fleshy lobe; fruit curved asymmetrical bearing a fleshy appendage on the concave side and on the convex side longitudinally striated in drying.

Petals united, confluent; inflorescence opposing the leaves; leaves membranaceous; filaments with a hairy internal flap. African. Species 1. Pl. I, figs. 16–22. ..... *Lasianthera.*

Petals free, or agglutinized at the edges with the sutures evident; inflorescence axillary; leaves thick coriaceous; filaments without the flap but hairy below the anthers inside. New Caledonia. Species 1. Pl. I, figs. 23–28. ..... *Gastrolepis.*

Pistil cylindrical or obovoid, without a skirt or appendage at the base; capped by a large fleshy glandular ring of tissue bearing the stigma sunken in its center; petals free; leaves coriaceous. Malay Peninsula. Species 1. Pl. II, figs. 1–7. ..... *Cantleya.*

Flowers functionally unisexual; pistil rudimentary in staminate flowers.

Petals free or at most agglutinized with the sutures manifest; pistil in female flowers asymmetrical, below the middle on the concave side with a fleshy gibbosity which is not free; stigma large and more or less conical; fruit asymmetrical with a large fleshy lateral appendage on the concave side. Species 6. Pl. II, figs. 8–15. ... *Medusanthera.*

Petals forming a tube, confluent, sutures not evident at the middle.

Anthers introrsely dehiscent, filaments longer than the anthers; corolla developed in the pistillate flowers, corolla-tube elongate 2–3 times the length of its lobes; leaves glabrous or with a simple pubescence.

Filaments usually 3–5 times as long as the anthers, fused to the corolla tube; fruit usually globular with a smooth apex and ruminated endosperm. Species 23. Pl. II, figs. 16–20. .... *Gonocaryum.*

Filaments usually 2–3 times as long as the anthers, free from the corolla tube; fruit usually ovoid to cylindrical and capped by the persistent stigmatic ring, seed with normal endosperm; raphe elongate, encircling the seed. Over 60 species described. Pl. I, figs. 7–15. ..... *Stemonurus.*

Anthers extrorsely dehiscent, filaments scarcely as long as the anthers; corolla reduced in pistillate flowers, corolla-tube very short, one-third to one-half the length of its lobes; leaves and the rest of the plant stellate pubescent; fruit cylindrical with normal endosperm. Species 8. Pl. II, figs. 21–27. ..... *Platea.*

The name *Stemonurus* has been applied to two distinct genera. Blume created the name *Stemonurus* in 1825 in his Bijdragen Flora Nederlandsch Indie (**13:** 648) to apply to a group of plants now known to consist of three distinct genera. In 1849 (Mus. Bot. Lugd.-Bat. **1:** 249–50) Blume recognized part of this confusion when he removed one of his previously described species from the generic concept, established

it as *Anacolosa,* a new genus of the Olacaceae, and published a new generic description for his emended *Stemonurus.* Unfortunately for the succeeding taxonomists his second description does not agree with his first. A plate (XLV) accompanied the second description and together these form the source of the confusion regarding the name *Stemonurus.* Valeton (Crit. Overz. Olac. 231. 1886) and Koorders and Valeton (Boomsoort. Java **5:** 145. 1900) have accepted the second publication and the plate as the plant Blume meant to be covered by the name Stemonurus (cf. Val. Icon. Bog. **1:** 40. 1901). Kuntze (Rev. Gen. **2:** 112. 1891), Engler (Nat. Pflanzenfam. III. **5:** 247. 1893) and others have employed the original 1825 description and applied the name to the plant indicated there.

The plants described in Blume's two diagnoses may be distinguished by the pistil and the fruits. The perianth and the stamens were not adequately described by Blume. There are supplementary characters available in the leaves and the habit that might also distinguish these two plants but these are not given by Blume.

Blume's first description reads "ovarium oblongum, 1-loculare, 2-ovulatum, ovula pendula. Stigma sessile, obtusum. Drupa baccata umbilicata, nucleo 1-spermo." The second description which is in agreement with the plate accompanying it describes "ovarium conicum v. cylindricum, ad basin disco brevi annulari cinctum, uniloculare. Ovula 2, ex apice loculi pendula anatropa. Stigma terminale, simplex v. conicum sulcatum. Drupa baccata nucleo fibroso, monospermo." The fact that these two descriptions do not agree and can not represent the same plant is evident and important. If the name *Stemonurus* is applied to the plant described in Blume's original diagnosis a new name must be accepted for that described in his later diagnosis.

Plants which do agree with the first description (Plate I, figs. 7–15) are those related to *Stemonurus javanicus* or *Gomphandra javanica.* I have not been able to examine Blume's material but I have seen an isotype of *S.* or *G. axillaris, S. coriaceus* or *G. coriacea,* and *S. penangianus* or *G. penangiana* which subsequent authors have considered as congeneric if not synonymous with Blume's *S. javanicus.* Here the flowers are unisexual by abortion. The flowers which are functionally female have an oblong or cylindrical pistil (Pl. I, fig. 8) capped by a large ring of tissue. This ring has been regarded as glandular with a central portion functioning as a stigma. This interpretation seems quite correct for the "glandular" portion in the herbarium specimens has a different color and texture from the mass of the ovarian tissue. This glandular ring and the stigmatic portion enlarges as the flower matures and

becomes, soon after fertilization, almost twice the width of the ovary. Then as the fruit develops the ovary increases in width until the mature fruit is ovoid to cylindrical in shape and capped by this proportionally smaller and persistent glandular ring (Pl. I, fig. 7). Blume described this fruit as umbilicate in his first diagnosis due to the "carunculate" gland at its apex. The stamens in the pistil-bearing flowers in all the material I have examined are sterile. In the male flowers the stamens however develop pollen but here the pistil remains rudimentary. The general shape of this rudiment is usually depressed-conical, however it may assume many shapes and Miers has created several species using the form of these rudiments among his characters (Pl. I, figs. 14–15). These pistillate rudiments may however contain a single locule, at the apex of which is borne two rudimentary ovules. I am in agreement with Valeton (Crit. Overz. Olac. 213. 1886) in the belief that these never develop.

The second description published by Blume and the plate which accompanies it applies to a group of species centered around *Stemonurus* or *Urandra secundiflora* (Pl. I, figs. 1–6). Here the flowers are always perfect. The pistils of all flowers have an ovoid form tapering to a conical apex and terminated by a punctate stigma (Pl. I, fig. 2). The pistil in this group has at its base a thin membranaceous flap of the ovary wall completely surrounding the lower portion which can be aptly described as a "skirt." Upon maturing the pistil develops into a baccate, narrow-oblong drupe (Pl. I, fig. 1) which is tapered to an obtuse apex and base and as Thwaites points out (Enum. Pl. Zeyl. 43. 1858) "drupa baccata, nucleo fibroso does not apply to *Gomphandra* [*Stemonurus javanicus* or *G. javanica*] though it does to species figured in the Mus. Bot. Lugd. Bat." In contrast with the condition previously described this fruit lacks the terminal persistent glandular structure. Instead, the apex here is quite smooth. There is nothing in the form of this fruit which could be confused with that mentioned in the first description given by Blume. It is to be noticed that Blume's first description places weight on the fruit, there being a good description of that structure, but his second emphasizes the condition of the pistil. This change of emphasis, the omission of the word umbilicate, and the additional phrase describing the basal skirt in the two publications indicate that two forms are involved and that the name *Stemonurus* must be applied to the *S. javanicus* form.

The name *Gomphandra* which has been used by some authors in connection with the species here being discussed was first suggested by Wallich in Roxburgh's Flora Indica (**2**: 329. 1824). Wallich described a sec-

ond species of the genus *Lasianthera* and commented "I am very doubtful whether this can be considered as a species of the genus established by M. Palisot de Beauvois whose work quoted above I have not had access to. In the event of its proving distinct I would propose *Gomphandra* as the generic name for it." Its use here is, therefore, invalid being a provisional name. In his catalogue in 1831–2 Wallich again uses the name in two binomials, *G. axillaris,* and *G. penangiana,* (numbers 3718 and 7204). These are likewise invalid being nomina nuda. These binomials were subsequently validated in the appendix of the second English edition of Lindley's Natural System (p. 439) in 1836. These two Indian plants are congeneric with *S. javanicus* and consequently fall in *Stemonurus* as first described by Blume. Since the name *Gomphandra* which Wallich applied to these Indian species was not validated until 1836 that name must fall into synonymy of *Stemonurus* (1824).

This conclusion necessitates a new name for plants covered by the second diagnosis of Blume, that centering around *S. secundiflorus*. *Urandra* Thwaites (Hook. Kew Jour. Bot. **7**: 211. 1855) is the only other name that has been applied to the complex of *S. secundiflorus*. In fact, *Urandra* appears to be the correct name for the complex. This application of the name has been used by Kuntze (Rev. Gen. **2**: 113. 1891) and Engler (Nat. Pflanzenfam. III. **5**: 248. 1893).

Several other names have been applied to this group of forms and should be briefly considered. Miers (Ann. Mag. Nat. Hist. ser. II, **10**: 30. 1852) failed to distinguish between *Lasianthera, Stemonurus,* and *Urandra* and treated them as congeneric. The oldest name *Lasianthera* was rejected by Miers because of its grammatical construction. He therefore applied the next oldest name of *Stemonurus* to the complex that involved even forms of *Platea* and *Gonocaryum*. Differing from Miers, Miquel (Fl. Ind. Bat. **1**[1]: 790. 1856) refused to reject *Lasianthera,* though he applied the name to the same large complex of species. Thwaites (Enum. Pl. Zeyl. 44. 1858) described under the name *Platea* several species belonging to *Stemonurus*. Bentham and Hooker (Gen. Pl. **1**: 350. 1862) correcting many of these errors segregated the complex, treated *Urandra* as a synonym of *Lasianthera* and applied the name *Gomphandra* to forms centering around *Stemonurus javanica*. Baillon (Hist. Pl. **5**: 329. 1874) followed Miquel in his very broad definition of *Lasianthera*. Masters (Hook. f., Flora Brit. India **1**: 584. 1875) and Alston (Trimen, Handb. Fl. Ceylon **6**: 48. 1930) have followed Bentham and Hooker. Beccari (Mal. **1**: 109. 1877) and Valeton (l.c.) use the names *Gomphandra* and *Stemonurus* for *Stemonurus javanicus* and *Urandra secundiflora* respectively. As has been explained the definition of *Stemonurus*

and *Urandra*, as accepted by Kuntze and followed by Engler is that here accepted by the present author.

New descriptions of these genera and a key distinguishing them from related genera have been prepared. Since so many species of this complex have been described, no attempt has been made in this paper to evaluate them. The forms now considered under the name *Urandra* are easily recognized from most descriptions but it is obvious to any investigator of this complex that the remainder of the species described belong to more than one genus. For that reason the generic description given for *Stemonurus* excludes the polypetalous species of *S. Merrittii*, *S. megacarpus*, and *S. lysipetalus* (Stapf) Merr. described under the name *Stemonurus* and restricts the genus to species having a tubular corolla with corolla tissue confluent and the petal sutures absent. A more complete treatment of the genus will be presented in a later paper.

Urandra celebica (Val.) comb. nov.

Stemonurus celebicus Val. in Koorders, Meded. 'S Lands Plantent. **19**: 394. 1898.

Urandra comosa (King) comb. nov.

Gomphandra comosa King, Jour. As. Soc. Beng. **64**²: 112. 1895.

Urandra dolichophylla (Merr.) comb. nov.

Stemonurus dolichophyllus Merr. Univ. Calif. Publ. Bot. **15**: 171. 1929.

Urandra evenia (Stapf) comb. nov.

Stemonurus evenius Stapf, Kew Bull. **1906**: 71.

Stemonurus cambodianus (Pierre ex Gagnep.) comb. nov.

Gomphandra cambodiana Pierre ex Gagnep. Not. Syst. **1**: 199. 1910.

Stemonurus dolichocarpus (Merr.) comb. nov.

Gomphandra dolichocarpa Merr. Pap. Mich. Acad. Sci. **23**: 183. 1937.

Stemonurus fulgineus (Elm.) comb. nov.

Urandra fulginea Elm. Leafl. Philip. Bot. **2**: 491. 1908.
Gomphandra fulginea (Elm.) Merr. Enum. Philip. Pl. **2**: 490. 1923.

Stemonurus lancifolius (Merr.) comb. nov.

Gomphandra lancifolia Merr. Philip. Jour. Sci. **17**: 277. 1920.

Stemonurus luzoniensis (Merr.) comb. nov.

Urandra luzoniensis Merr. Philip. Jour. Sci. Bot. **3**: 242. 1908.
Gomphandra luzoniensis (Merr.) Merr. Enum. Philip. Pl. **2**: 490. 1923.

Stemonurus nyssifolius (King) comb. nov.

Gomphandra nyssifolia King, Jour. As. Soc. Beng. **64**²: 114. 1895.

Stemonurus oblongifolius (Merr.) comb. nov.

Gomphandra oblongifolia Merr. Philip. Jour. Sci. Bot. **17**: 276. 1920.

Stemonurus oppositifolius (Pierre ex Gagnep.) comb. nov.

Gomphandra oppositifolia Pierre ex Gagnep., Lecomte Not. Syst. **1**: 198. 1910.

Stemonurus salicifolius (Ridl.) comb. nov.

Gomphandra salicifolia Ridl. Jour. As. Soc. Straits Br. **82**: 176. 1920.

Stemonurus subrostratus (Merr.) comb. nov.

Gomphandra subrostrata Merr. Pap. Mich. Acad. Sci. **19**: 164. 1933.

Stemonurus Yatesii (Merr.) comb. nov.

Gomphandra Yatesii Merr. Pap. Mich. Acad. Sci. **19**: 165. 1934.

MEDUSANTHERA Seemann

Medusanthera Seemann, Jour. Bot. **2**: 74. 1864.

Stemonurus Seemann, Flora Vitiensis 39. 1865, in part.
Tylecarpus Engler, Nat. Pflanzenfam. III, **5**: 247. 1893; Lloyd and Aiken, Bull. Lloyd Lib. No. 33, Bot. Ser. **4**: 65, fig. 1934.
Lasianthera Becc. Mal. **1**: 108, tab. 3. 1877, in part.

Medusanthera vitiensis Seemann, Jour. Bot. **2**: 74. 1864.

Stemonurus Vitiensis (Seemann) Seemann, Fl. Vit. 39, pl. 12. 1865.
Gomphandra vitiensis (Seemann) Val. Crit. Overz. Olac. 230. 1886.
Lasianthera (*St.*) *Vitiensis* (Seem.) Becc. Mal. **1**: 108. 1877.

Medusanthera papuana (Becc.) comb. nov.

Lasianthera papuana Becc. Mal. **1**: 108, tab. 3. 1877.
Tylecarpus papuana (Becc.) Engler, Nat. Pflanzenfam. III. **5**: 247. 1893.

Medusanthera australis (C. T. White) comb. nov.

Tylecarpus australis White, Queensland Dept. Agric. Bull. **20**: 12, fig. 1918.

Medusanthera samoensis (Reinecke) comb. nov.

Tylecarpus samoensis Reinecke, Bot. Jahrb. **25**: 650. 1898; Lloyd and Aiken, Bull. Lloyd Lib. No. 33, Bot. Ser. **4**: 65, fig. 1934.

Medusanthera carolinensis (Kanehira) comb. nov.

Gomphandra carolinensis Kanehira Fl. Micron. 198, fig. 85. 1933, Bot. Mag. Tokyo **47**: 673. 1933.
Tylecarpus carolinensis (Kanehira) Kanehira and Hatusima, Bot. Mag. Tokyo **50**: 605. 1936.

Medusanthera glabra (Merr.) comb. nov.

Gomphandra glabra Merr. Philip. Jour. Sci. Bot. **17**: 277. 1920.

Medusanthera laxiflora (Miers) comb. nov.

Stemonurus laxiflorus Miers, Ann. Mag. Nat. Hist. ser. II, **10**: 111. 1852.
Platea laxiflora Miers, l.c. 111. 1852.
Gomphandra laxiflora (Miers) Rolfe, Jour. Bot. **23**: 211. 1885.
Cissus flexuosa Turcz. Bull. Soc. Nat. Mosc. **31**: 115. 1858; Planch. in D. C. Monog. Phan. **5**: 624. 1887; Merr. Enum. Philip. Pl. **2**: 420. 1923.

In his treatment of the Icacinaceae for the Natürlichen Pflanzenfamilien in 1893 Engler based a new genus, *Tylecarpus*, on the species *Lasianthera papuana* Becc. Since then three species have been added: *T. australis* C. T. White, *T. samoensis* Reinecke, and *T. carolinensis* (Kaneh.) Kanehira and Hatusima, the latter being a recent transfer from *Gomphandra*.

There is, however, an older name for the group. Seemann (1864) established the monotypic genus (*Medusanthera* for *M. vitiensis* from Fiji. He later referred it to *Stemonurus* in his Flora Vitiensis but since that time various authors have mentioned it and have not referred it with certainty to any particular genus. Beccari, in a foot-note (Mal. **1**: 108. 1877) thought it might be a *Lasianthera*, with which this plant certainly has a superficial similarity in the fruits, and referred the species to that genus. Valeton disagreed and referred it to *Gomphandra*.

I have examined an isotype of *M. vitiensis* and find that while most authors in the past have regarded it as having hermaphroditic flowers they are actually unisexual. The type as figured by Seemann (Flora Vitiensis pl. 12. 1865–73) is a staminate example. Recent collections from Samoa (Gillespie 3517) have female flowers and very immature fruits. It is apparent that this plant represents the same group as *Tylecarpus papuana* (Becc.) Engl. and since the name *Medusanthera* is older it must replace the former.

The genus is easily recognized by its characteristic fruits but it also has a habit which permits it to be readily identified. The genus has unisexual flowers with the pistil in the male flowers usually small and conical. Although usually undifferentiated I have seen one example (*M. laxiflora*. Wenzel 2947) where a locule is present in this rudiment although there was not any indication of ovule development. In the female flowers the pistil is cylindrical with a gibbous fleshy mass on one side below the middle. The stigma is large and more or less conical, usually of a greater diameter than the ovary itself. This pistil is similar in form to that of *Stemonurus* which, however, lacks the basal gibbosity. The petals in both sexes of this plant are free, valvate, with an inflexed tip and are glabrous in all the examples I have seen. The axillary in-

florescence is quite typical and readily distinguishes the group; it is laxly cymose the branches being usually thin and delicate in flower but becoming thicker as the fruit matures. Compare the figures shown by Miers (Contrib. **1**: plate 16) and by Beccari (Mal. **1**: tab. 3). The flowers are articulated to the pedicel and usually occur in clusters of from 2 to 4. The fruit, as mentioned before, is characteristic resembling very much that of *Gastrolepis, Lasianthera,* or *Discophora.* At maturity it is curved and asymmetrical with a fleshy pad or appendage on the concave side, the same side which bears the gibbosity in the flowering condition. This appendage varies from slightly larger in width than the carpel itself (Becc. l.c. fig. 1) to over twice the width of the carpel (Lloyd and Aiken, Bull. Lloyd Lib. No. 33, Bot. Ser. **4**: 65, fig. 1934). The development of this will be considered in a future paper. The leaves of the species are very similar in appearance and the group can be recognized on this basis. The veins and mid-rib are sulcate above, the margin is revolute, the texture is sub-coriaceous, the dorsal surface is usually dull, and the ventral surface is slightly lighter in color.

The known range includes Samoa, Caroline Islands, Fiji Islands, New Guinea, Australia, and the Philippines.

CITRONELLA D. Don

Citronella D. Don, Edinb. New Phil. Jour. **13**: 243. 1832.

Villaresia Ruiz & Pavon, Fl. Peruv. Chil. **3**: 9, t. 231. 1802; A. Jussieu, Ann. Sci. Nat. **25**: 14, t. 3. 1832; not Ruiz & Pavon, Fl. Peruv. Chil. Prodr. 35. 1794.
Chariessa Miquel, Fl. Ind. Bat. **1**[1]: 794. 1856.
Pleuropetalon Blume, Mus. Bot. Lugd.-Bat. **1**: 248. 1850.
Sarcanthidion Baillon, Adans. **11**: 199. 1874.

Citronella costaricensis (Donn. Sm.) comb. nov.

Villaresia costaricensis Donn. Sm. Bot. Gaz. **31**: 110. 1901.

Citronella Engleriana (Loesn.) comb. nov.

Villaresia Engleriana Loesn. Notizbl. Bot. Gard. Berlin **3**: 20. 1900.

Citronella Gongonha (Mart.) comb. nov.

Cassine Gongonha Mart. Reise Bras. **1**: 285. 1823; Travels Braz. **2**: 100. 1824.
Ilex Gongonha D. Don in Lambert, Gen. Pinus, **2**: app. 7**, t. 6. 1824.
Myginda Gongonha D.C. Prod. **2**: 12. 1825.
Villaresia Gongonha Miers, Ann. Mag. Nat. Hist. Ser. III, **9**: 112. 1862.
Villaresia pungens Miers, Ann. Mag. Nat. Hist. Ser. III, **9**: 112. 1862.
Villaresia cuspidata Miers, Ann. Mag. Nat. His. Ser. III, **9**: 113. 1862.

Villaresia Gongonha C. Muell. Walp. Ann. **8**: 569. 1872.
Villaresia mucronata sensu Reiss. in Mart. Fl. Bras. XII. **2**: 75, t. 22. 1872, not Ruiz & Pavon.
Villaresia mucronata sensu Sprague, Bot. Mag. **137**: t. 8376. 1911, not Ruiz & Pavon.

The specific epithet is derived from the vernacular name for this plant. Early authors seem to vary in their spelling of this, some use a "C" while others use a "G." All the specific names used regarding this plant in the literature, however, have been given as *Gongonha*. It was originally described as a *Cassine* and then as *Ilex* in the Aquifoliaceae, where it was considered related to *Ilex paraguariensis*, the true source of Maté. As St. Hilaire (Guillem. Arch. Bot. **1**: 31. 1833) points out, it is actually inferior to the tea produced from the species of *Ilex*, however.

All the references in current literature cite Miers as the author of the binomial, actually he was responsible only for the combination under *Villaresia* with a change in the spelling of the vernacular name.

Ruiz and Pavon (Syst. Veg. Fl. Peruv. Chil. 14. 1798) refer this vernacular name to *Peperomia inaequalifolia* and spell it "Congonha."

Citronella incarum (Macbr.) comb. nov.

Briquetina incarum Macbride, Publ. Field Mus. Nat. Hist. Bot. Ser. **11**: 26. 1931.

Citronella latifolia (Merr.) comb. nov.

Villaresia latifolia Merr. Philip. Jour. Sci. Bot. **14**: 415. 1919.

Citronella megaphylla (Miers) comb. nov.

Villaresia megaphylla Miers, Ann. Mag. Nat. Hist. ser. 3, **9**: 114. 1862.
Villaresia citrifolia Borzi, Boll. Ort. Bot. Palermo **1**: 44. 1897.
Villaresia grandiflora Fisch. ex Regel, Gartenfl. **5**: 61. 1856, **6**: 1, t. 180. 1857, *V. grandifolia* on pl.
Villaresia grandifolia Fisch. & Mey. in sched. ex Mart. Fl. Bras. **12**^{2}: 54. 1872, as synon of *V. megaphylla*.

The two articles in Gartenflora by Regel on the cultivation of a species of *Villaresia* apparently deal with the same plant. The plate accompanying the second, however, is labeled *V. grandifolia* while the article is entitled *V. grandiflora*. The plant is apparently synonymous with *Citronella megaphylla*, although the pistil is figured without pubescence, but the other characters are in agreement.

Citronella Moorei (F. v. Mueller ex Bentham) comb. nov.

Villaresia Moorei F. v. Mueller ex Bentham, Fl. Austral. **1**: 396. 1863.
Chariessa Moorei (F. v. Mueller) Engl. Nat. Pflanzenfam. III, **5**: 245. 1893.

Citronella mucronata (Ruiz & Pavon) D. Don, Edinb. Phil. Jour. **13**: 243. 1832.

Villaresia mucronata Ruiz & Pavon, Fl. Peruv. Chil. **3**: 9, t. 231. 1802; A. Jussieu, Ann. Sci. Nat. **25**: 14, t. 3, fig. 2. 1832.

Villaresia chilensis (Mol.) Stuntz, U. S. Dept. Agric. Bur. Pl. Ind. Invent. Seed Pl. Imp. **32**: 39. 1914, not *Citrus chilensis* Molina.

As far as I have been able to find Miers was the first to place *Citrus chilensis* Molina in the synonymy of *Citronella mucronata*. Stuntz in 1914 noticed the name of Molina was older and published the new combination, *Villaresia chilensis* (Mol.) Stuntz for this group. Molina's first account of his species hardly fits *Citronella*. It reads "Citrus chilensis is distinguished from the common orange by sessile leaves and oval fruits which are not larger than a hazelnut and of which the taste is the same. The wood of this tree which reaches a considerable height is sought by wood workers because of its yellow color." Surely if this plant had been a true *Citronella* with its dry drupaceous fruit Molina would have found some other differences than the mentioned sessile leaves and smaller fruit. His statement concerning the taste almost assures us he knew an orange and it is hard to believe he could consider a fruit of *Citronella* as comparable. In the second edition of his book Molina (1810) describes the stems as ascending and armed with short spines, this certainly isn't *Citronella mucronata*. Bertero 1829, refers to *Citrus chilensis* in the following manner. "It is no different from *Citrus aurantium* except for the size of all of its parts" and he believes it should be a variety. Gay fails to mention *Citrus chilensis* in his discussion of *Citronella mucronata*.

I am not at all convinced this species of Molina belongs in synonymy here and for that reason I choose to disregard Stuntz' combination and retain *mucronata* as the specific epithet.

The relation of this plant to the oranges which is frequently cited in the literature probably comes through its vernacular name of Naranjillo and through Ruiz and Pavon's statement that it looks like a "Citronnier."

Citronella paniculata (Mart.) comb. nov.

Leonia paniculata Mart. Flora **24**[2]: Beibl. 26. 1841; D.C. Prod. **8**: 669. 1844.

Leretia paniculata Mart. Fl. Bras. **7**: 17. 1856.

Villaresia paniculata (Mart.) Miers, Ann. Mag. Nat. Hist. ser. 3, **9**: 116. 1862.

Citronella paraguariensis (Hassler) comb. nov.

Villaresia paraguariensis Hassler, Repert. Spec. Nov. **14**: 164. 1915.

Citronella peruviana, sp. nov. PLATE IV.

Arbor vel frutex(?); ramis teretibus glabris pallide brunneis; ramulis fulvo-hirsutis; foliis maturis late lanceolatis vel ellipticis coriaceis utrinque glabris 12–18 cm. longis et 5–8 cm. latis, apice anguste acutis, basi rotundatis vel obtusis plus minusve obliquis margine spinoso-dentatis (dentibus usque ad 2 mm. longis), supra in sicco cinereo-brunneis, subtus brunneis; costa prominente; venis primariis 5, supra leviter sulcatis, subtus prominentibus arcuatis laxe anastomosantibus, nervis secondariis prominulis; petiolis crassis 0.5–0.6 cm. longis; folius juventute margine sinuatis utrinque sparse fulvo-hirsutis; inflorescentiis axillaribus vel extra-axillaribus, immaturis ca. 8 cm. longis, flores sessiles gerentibus, ramulis racemose dispositis 5–10-floris recurvatis flavo-pilosis usque ad 1.5 cm. longis; calyce breviter campanulato, lobis laxe imbricatis ovatis obtusis praesertim apicem versus fulvo-pilosis, 2 mm. longis et latis; petalis oblongis margine sinuatis crassis carnosis laxe imbricatis glabris 5 mm. longis 2 mm. latis; staminibus 2.2–2.8 mm. longis, antheris oblongis vel ovatis, 0.5–0.8 mm. longis basi divergentibus, connectivo haud incrassato; filamentis ca. 2 mm. longis et latis basi valde dilatatis apicem versus attenuatis; ovario glabro, stylo sulcato 0.8 mm. longo, stigmate obliquo; fructu ignoto.

PERU: Dept. Junin, Rio de Comas, alt. 2400–2500 m. 1909–1914 *Weberbauer 6617.* (TYPE Gray Herbarium, ISOTYPES F.M., U.S.)

The plant described above resembles both *Briquetina* and *Villaresia* as these have been defined by recent authors. In its leaf texture and in the distinctive inflorescence it is closest to *C. incarum* from which it differs in the shape of the leaf and its spinose margins. Also the petals are about two-thirds the length of those of *C. incarum.* The inflorescences consist of racemosely arranged cymes. The individuals cymes bear 5–10 sessile flowers and are characteristically recurved at maturity. Occasionally, the lower ones elongate to twice the length of the upper. The young leaves on terminal shoots have sinuate margins but the mature or older leaves have spinose margins. In this character it resembles *C. mucronata* or *C. Gongonha* which have spinose margined leaves on sucker or vigorous shoots. Possibly there may be similar variation in *Citronella peruviana.*

Citronella philippinensis (Merr.) comb. nov.

Villaresia philippinensis Merr. Philip. Jour. Sci. Bot. **14**: 414. 1919..

Citronella ramiflora (Miers) comb. nov.

Villaresia ramiflora Miers, Ann. Mag. Nat. Hist. ser. 3, **9**: 116. 1862.

Citronella samoensis (A. Gray) comb. nov.

Pleuropetalon Samoense A. Gray, U. S. Explor. Exped. Bot. Phan. **1**: 299, pl. 27. 1854.
Chariessa samoensis (A. Gray) Engler, Nat. Pflanzenfam. III, **5**: 245. 1893.
Villaresia Samoense (A. Gray) Val. Crit. Overz. Olac. 199. 1886.

Citronella sarmentosa (Baill.) comb. nov.

Sarcanthidion sarmentosum Baill. Adans. **11**: 199. 1874.

Citronella Smythii (F. v. Muell.) comb. nov.

Villaresia Smythii F. v. Mueller, Frag. **5**: 156. 1866.
Chariessa Smythii (F. v. Muell.) Becc. Mal. **1**: 118. 1877.
Villaresia adenophylla Domin, Bibliot. Bot. **89**: 50. 1921.

I have not seen Domin's material but there seems to be no reason for retaining this as a distinct species since it is in agreement in all characters with *Citronella Smythii*.

Citronella suaveolens (Blume) comb. nov.

Pleuropetalon suaveolens Blume, Mus. Bot. Lugd.-Bat. **1**: 248. 1850.
Chariessa suaveolens (Bl.) Miq. Fl. Ind. Bat. **1**[1]: 794. 1856.
Villaresia suaveolens (Bl.) Val. Crit. Overz. Olac. 199. 1886.

Citronella virescens (Miers) comb. nov.

Villaresia virescens Miers, Ann. Mag. Nat. Hist. ser. 3, **9**: 115. 1862.

The species to which Ruiz and Pavon originally applied the name *Villaresia* is a very different plant from that which bears the name today. *Villaresia* was described in Prod. Fl. Peru and Chili in 1794 with the species *V. emarginata* being listed in the Syst. Fl. Peruv. Chil. in 1798. The original description concerns a plant with a sessile stigma, an oblong acuminate 2-valved 1-seeded capsule with an oblong tetragonal seed surrounded by a fleshy arillus. This is obviously different from the plants of the Icacinaceae which currently bear that name. This latter can be described as having the style evident, filiform to stout; fruit a globular drupe, indehiscent, putamen with a vertical partition extending inward half the diameter of the mature locule, the seed curved around this appearing hippocrepiform in section, no fleshy arillus present.

In the third volume of Flora peruviana et chilensis (1802) Ruiz and Pavon describe and give a plate illustrating the second species of their genus, *V. mucronata,* which is the basis of the present concept of the genus. This is quite a different plant from that indicated in the original publication. A. Jussieu (Ann. Sci. Nat. **25**: 14. 1825) was the first to notice this discrepancy, commenting that the first description is different and inexact. He accepted the name *Villaresia,* however, for the

icacinaceous genus. D. Don (Edinb. New Phil. Jour. 13: 243. 1832) insisting that the name *Villaresia* should be applied to the apparently celastraceous plant originally described, coined a new name, *Citronella,* for the icacinaceous plant which Jussieu and most subsequent botanists have called *Villaresia.* The name *Citronella* was suggested by a Chilean vernacular name for *V. mucronata* R. & P. The original description of *Villaresia* in R. & P. Prodromus has no illustration though most other genera described are figured. Don suggests that the specimens and the plate of the original plant were lost in the shipwreck of the San Pedro de Alcantara. The name *Citronella* was not taken up by later authors and has since been carried in synonymy, though it is the oldest available name for this genus.

Another name applying to the icacinaceous genus is *Pleuropetalon* which was published by Blume in Mus. Bot. Lugd.-Bat. in 1850. Asa Gray described a second species, *P. samoense,* in 1854 noting then its superficial affinities with *Bursinopetalum* and *Villaresia. Pleuropetalon* of Blume is antidated by *Pleuropetalum* Hook. f. of the Portulacaceae which was established in 1845. In 1855, Miquel, for this reason, changed Blume's name to *Chariessa.* Bentham and Mueller recognizing their similarities combined *Villaresia* and *Chariessa.* Beccari distinguished between them but Valeton reunited them. Engler distinguishes between the two genera on weak characters which I do not consider of value, that is the corolla imbricated in *Villaresia* and valvate in *Chariessa,* this condition will be discussed later. Since 1893, Merrill and Domin have combined the two genera under the name *Villaresia.* It appears to me that their similarities are so much stronger and of more importance than their very slight differences, that it is advisable to consider them as congeneric. This conclusion is supported by consideration of the intermediate form of two other genera which are related here.

Briquetina was proposed by Macbride in 1931 and is to be referred to this complex. This form is intermediate in several ways between the Old World group of *Chariessa* and the New World forms of *Villaresia.* In *Citronella peruviana* Howard (Plate IV) the inflorescence is intermediate and the leaves which are large as in *Briquetina incarum* and have a spinose margin which has been troublesome to past workers in the South American species of *Villaresia.*

Sarcanthidion Baillon must also be referred to this group. This plant is known only from New Caledonia and has a sarmentose or climbing habit which has been used to set it apart from the other genera here considered, although Baillon did recognize its affinities with *Villaresia.* Engler distinguishes it by the curved style and a capitate instead of

oblique stigma, nevertheless both of these characters are found in *Citronella* as a whole. Valeton places the two genera side by side but fails to comment on them beyond recognizing their similarities. In the structure of the flower, and the wood this genus is indistinguishable from *Citronella* and likewise has the characteristic ovary and inflorescence which easily separates this group from the rest of the Icacinaceae.

Another form worthy of mention is *Citronella costaricensis* (Donn. Sm.) Howard which was originally described as a *Villaresia*. Its inflorescence approaches that found in *Briquetina incarum;* its leaves are more nearly like those of *Citronella paniculata* and *Citronella megaphylla* and in its wood structure it has certain peculiarities which are commonly found in the Old World species of *Chariessa*. The range is new world and thus the species serves as another example of a plant with intermediate characters which supports the consideration of these genera as one large group under the name *Citronella,* the oldest valid name.

The fruit of this genus contains its most interesting and distinctive character. In the pistil the funiculus runs up the inside of the locule appearing as a ridge protruding into the space. The two ovules are pendant from near the apex, one on each side of this ridge. (Plate IV, fig. 6–7.) When the fruit matures the ridge enlarges and forms a radial partition extending half the diameter of the locule and running vertically. Miers called this ridge a dissepiment since he believed it was formed through the abortion of one or more extra locules. He considered the genus as belonging in the Aquifoliaceae and therefore a continuation of the tendency in that family to reduce the carpellary number of the flower. Miers also found a pistil with two locules which he regarded as support to his conclusion. Valeton, contrarily does not regard this as formed through abortive carpels. He found this ridge to contain vascular strands and so to be of independent origin from any loss of carpels. To this ridge he applied the term "richel." Only one of the two ovules in the pistil of the Icacinaceae develops and in the fruit the seed is curved around the partition. Thus in a cross section the seed appears to be hippocrepiform. While this fruit and seed shape are distinctive and diagnostic for the genus *Citronella* of the Icacinaceae, instances of similar characters have been reported in other families. Miers (Ann. Mag. Nat. Hist. ser. 3, **9**: 108. 1862) and A. Jussieu (Ann. Sci. Nat. **25**: 14. 1832) and others have considered these in detail. The one I have found most often confused in the herbarium, however, is *Bursinopetalum* or *Mastixia* of the Cornaceae which has this same projection of the endocarp or putamen into the locule. This is easily distinguished however by its perigynous flowers and inferior fruit. The

comparison is often made with the condition found in the Menispermaceae, however the situations in these two groups are not strictly similar. In the Menispermaceae as A. Jussieu (l.c.) points out the entire seed and embryo are curved upon a horizontal plane with the partition thus formed running horizontally instead of vertically and so are easily distinguished from the genus *Citronella*.

A second peculiarity of the genus *Citronella* is the aestivation of the corolla. (cf. Plate IV, fig. 3, 5.) The petals are free, very fleshy for the family and with a strongly protruding mid-rib. The apex of the petals is inflexed and the top of the bud shows all five petals at its depressed center. The margins of these petals, however, are usually membranaceous, not at all fleshy as at their centers, and overlap. For this reason the petals have been regarded as imbricated. A. Gray (U. S. Explor. Exped. Bot. Phan. **1**: 301. 1854) calls this condition a mixture of the two forms since the petals at their bases are valvate abutting each other or often separated. Although the petals overlap at the margins and especially so at the shoulders or curve of the corolla in bud condition I believe the condition to be a modified valvate aestivation rather than an imbricated one. I know of no example where the corolla, regarded as truly imbricated has the apices of the petals free and inflexed as they are here. Usually in an imbricated condition the apices too overlap. Engler's key distinction, that the old world *Chariessa* forms are valvate in contrast with the remainder of the forms is not exact and can not be used. The amount of overlapping of the margins of the petals is variable and flower buds on the same inflorescence show all degrees of this.

The leaves of this genus, particularly several of the new world species, may have their margins spinose. Miers (Ann. Mag. Nat. Hist. ser. 3, **9**: 112. 1862) described *Villaresia pungens* from a specimen of this sort. Many of the collections I have examined have both types of leaves on the same sheet. Apparently the plant develops spinose margined leaves on the young or sucker shoots. Sprague, (Bot. Mag. t. 8376. 1911) in his plate labeled *Villaresia mucronata*, which is really *Citronella Gongonha*, also shows variations of this type which exist on the same tree in cultivation. It is likewise apparent that the distinctions used to separate *C. Gongonha* and *C. cuspidata* on the basis of entire or spinose-margined leaves is not acceptable, especially since many leaves with one or two spines on the margins are to be found. I regard these two species as synonymous. The case of *C. peruviana* has already been mentioned.

The leaves of several of the South American forms of *Citronella* bear small cavities in the axils of the veins on the ventral side of the leaf.

These have been called glands by various authors. I have not been able to verify this glandular condition although they often bear inside a thin walled clavate or thick walled lanceolate pubescence. In the larger forms small insects have been found. Miers considers the presence of these pores a major character and from my material their occurrence seems to be quite consistent.

CANTLEYA Ridley

Cantleya Ridley, Fl. Mal. Penin. **1**: 436. 1922.

Flowers hermaphroditic, calyx 5-parted, segments lightly imbricated, petals 5, rarely 4, bearing a longitudinal ridge inside, apex inflexed or appendaged, valvate, glabrous; stamens 5 rarely 4, alternating with the petals, filaments thickened, fleshy, broad, bearing inside and outside a clavate pubescence, anthers ovate diverging at the base, introrsely and longitudinally dehiscent, affixed at the apex; ovary cylindrical to obovoid, unilocular, style none, stigma sunken in the middle of a large fleshy ring of differentiated tissue which caps the ovary, ovules 2, pendent from near the apex on a common funiculus; fruit unknown.

Cantleya corniculata (Becc.) comb. nov. Plate II, figs. 1–7.

Platea corniculata Becc. Mal. **1**: 117. 1877.
Urandra sp. Foxw. Philip. Jour. Sci. **4**: 492, 542, fig. 47. 1909.
Urandra corniculata (Becc.) Foxw. Philip. Jour. Sci. **6**: 179. 1911.
Cantleya johorica Ridl. Fl. Mal. Penin. **1**: 436. 1922.
Stemonurus corniculatus (Becc.) Ridl. Fl. Mal. Penin. **5**: 297. 1925.

A small tree, branches angular, internodes short 1–2 cm. long, bark rough, gray to brown: lamina of the leaves broadly ovate-elliptic to sub-ovate, 5–6.5 cm. long and 3.5–4.5 cm. wide, the apex abruptly narrowed into an acuminate point 4–7 mm. long and 2–3 mm. wide, obtuse, base rounded, coriaceous, fragile when dry, when young velutinous pubescent, at maturity glabrous, margin entire or slightly revolute, mid-rib sulcate above, prominent below, veins inconspicuous, drying a tobacco brown; flowers perfect, 5- rarely 4-parted; calyx short, 0.8–1 mm. high and 1.6–1.8 mm. in diameter, lobes imbricate, fleshy, ovate, pilose-pubescent; corolla valvate, petals free, oblong, 5.2 mm. long by 1.2 mm. wide, inflexed tip 0.6 mm. long, fleshy, glabrous, mid-rib evident; stamens alternate, 4.5 mm. long in the mature bud; filaments broad, fleshy, thick, bearing clavate thin-walled hairs below the anther inside and on the shoulder of the filament outside; anthers ovate, diverging at the base, anther sacs commonly reniform, 0.7 mm. long, affixed to the top of the filament and hanging free at the base; ovary

cylindrical to obovoid, 2.8 mm. high, stigma slightly eccentric, ovules two from a common funiculus. Fruit unknown. Inflorescence axillary, of peduncled cymes, peduncles 1–2 cm. long, at the base covered by a number of spirally arranged bracts, flowers sessile, articulated, in clusters of 4 to 8.

BORNEO: ex Herb. Hort. Bot. Kew 2797 (A); *Moulton s.n.* (A). FEDERATED MALAY STATES: Singapore Bot. Gard., Field no. 26182 (*Corner*) (A). SUMATRA: ex Herb. Hort. Bot. Kew 18559 (A). JAVA: ex Herb. Hort. Bot. Bog. (UC. 265771).

Beccari described the flowers of this plant as monoecious to polygamous. In the staminate flowers he mentions "ovarii rudimentum depressum discoideum." In the female flowers he reports, petals none. Ridley reports (Suppl. Fl. Mal. Pen. **5**: 297. 1925) the flowers to be perfect. In the five collections I have examined both fertile anthers and fertile pistils were present. More material of this genus is badly needed for study but on the basis of the specimens available it seems certain the flowers are perfect.

Cantleya corniculata was originally described by Beccari as a species of *Platea*. In 1911 Foxworthy reports sending specimens collected by Moulton to Beccari for identification and receiving a reply that the material was identical with that described as *P. corniculata* from incomplete material cultivated at the Buitenzorg gardens. A copy of this excerpt is on file at the Arnold Arboretum Herbarium. Foxworthy felt the plant belonged in *Urandra* and therefore made the new combination. Ridley in 1922 described a new genus on incomplete material which he called *Cantleya johorica*, since it was collected by Cantley in Johor. This was also based on incomplete material. In the supplement to Fl. Mal. Pen. he relates having seen the material described by Foxworthy and concluded his previously described monotype was identical with it. He disagreed with Foxworthy's choice of genera and made a new combination in the genus *Stemonurus*.

I have examined material of Moulton's collections which have been so frequently cited in the literature, as well as material from Kew and Buitenzorg. The material has several basic differences which makes it advisable to consider this a distinct genus. This conclusion is supported by striking differences from other genera of the Icacinaceae in the wood structure and in the pollen grains. This latter information will be published in further studies of the family. This genus in the form of its pistils resembles *Stemonurus*. However, the flowers in *Cantleya* are perfect instead of unisexual. The leaves are entire, revolute margined, coriaceous and inconspicuously veined as in *Urandra* but the

flower structure is different in these two. The branching habit of the inflorescence is somewhat like that of *Medusanthera* but the perfect flowers and the lack of development of an asymmetrical pistil as well as the basically different stigma allow easy separation. The inflorescence in its bracts at the base and the flowers articulated from the alveoli is characteristic and distinct.

Ridley (Kew Bull. 1926: 61) described *Stemonurus pauciflorus* with "affinis *S. corniculato* Ridl., sed inflorescentia multo laxiore floribusque paucioribus minoribus." I have not seen material of this and from the general description given I can not place the plant in the genus here considered. Two clues can be discerned which might designate it as a species of *Urandra* namely, "floribus albis 5–6 secundis" and "ovario conico acuminato." If this plant should prove to be a distinct species the name must be changed since Blume, Stapf, and Merrill have already used this name for different plants in this complex.

The valid name for *C. corniculata* representing a generic unit is *Cantleya*. There appears to be only one species.

GASTROLEPIS Van Tieghem

Gastrolepis Van Tieghem, Bull. Soc. Bot. Fr. **44**: 115. 1897.

Flowers hermaphroditic, calyx short-campanulate, 5-toothed or -lobed; petals 5, valvate, free, or if agglutinized into a tube with the sutures evident, apex inflexed or appendaged, glabrous inside; stamens 5, filaments broad, fleshy, arched behind the anther sacs into a shoulder, continuous into a filiform connective at the upper portion of which are attached the anther sacs, filaments bearded from lateral margins and not an adaxial flap, barbate abaxially between the anther sacs, anthers oblong, introrsely and longitudinally dehiscent; ovary unilocular, pyramidal, slightly curved with a large fleshy free lobe at the base, style short, stigma capitate, slightly eccentric, ovules 2, flattened, lying parallel to the ovarian lobe, pendent from near the apex of the locule, anatropous with the micropyle turned laterally; fruit a drupe (seen only in an immature state), compressed, incurved, asymmetrical, when drying longitudinally striated on the convex side, bearing a fleshy evanescent portion on the concave side, seed flattened, single. Inflorescence axillary, cymose, flowers articulated, in small clusters. Tree with alternate, entire, glabrous, coriaceous leaves. One species from New Caledonia.

Gastrolepis austro-caledonica (Baill.) comb. nov. Plate I, figs. 23–28.

Lasianthera austro-caledonica Baillon, Adans. **11**: 193. 1874.

Van Tiegham based this genus on *Lasianthera austro-caledonica* of

Baillon. Since he only implied the combination and I have been unable to find it in print elsewhere it is given here as a new combination. Likewise, a complete generic description has not been published and that accompanying is a more ample characterization of the genus.

The only conformation of *Gastrolepis* with *Lasianthera* is in the lateral flap of the ovary wall. It differs in its geographical distribution and its inflorescence being axillary instead of opposing the leaves. The corolla here is composed of free petals or if they are agglutinized into a tube their sutures are evident. In the stamens of *Lasianthera* there is an adaxial flap on the filament below the anthers to which clavate and barbate hairs are attached. In *Gastrolepis,* however, this flap is absent and the hairs which in all my material are lanceolate and not clavate are located on the lateral margins of the filament and are sparse to absent in the center. The leaves of *Gastrolepis* are thick and coriaceous and similar to *Urandra,* in contrast with the thin membranaceous ones found in *Lasianthera africana.* On the basis of the immature fruits of both genera the drupes appear to be similar. In the pollen grains there is a striking difference between them.

Baillon describes the leaves of this species as obovate to subelliptical, apex round to emarginate, base cuneate rarely round. Of the material I have had for study one collection (Franc 1791) has typical obovate leaves with cuneate bases and emarginate apices. A second collection (Franc 234) has one sheet (U. S. 1595512) with acute apices, elliptical to oblong leaves and rounded bases. Two other sheets with the same collector's number, however, are more intermediate with rounded apices, elliptical leaves and broadly cuneate to rounded bases. With so little material at my disposal with which to ascertain the limits of leaf variation it seems inadvisable to call the latter collection a new species although it may well be. Further study may reveal a single polymorphic species. However, the first form mentioned (Franc 1791) has so little variation in the stages of development represented in the collections I have seen, that it appears unlikely to be a case of leaf polymorphy.

PLEURISANTHES Baillon

Pleurisanthes parviflora (Ducke) comb. nov.

Lorctia parviflora Ducke, Arch. Jard. Bot. Rio Janeiro 4: 119. 1925.
Mappia parviflora (Ducke) Baehni, Candollea 7: 174. 1936.

This interesting species is in agreement with *Pleurisanthes* by its flowers which are not articulated with the pedicel; the petals which are glabrous within, by its leaves which have a setose pubescence of sculptured and smooth walled hairs, and by the supra-axillary inflo-

rescences which have flattened branches. These developments are characteristic of the genus *Pleurisanthes*. In habit *P. parviflora* approaches *P. flava* Sandw. from which it is easily distinguished by its elongated and gracefully branching racemes, as well as by its flowers which have a pistil with a glabrous style as long as the ovary, and its petals which in my material bear on the inside at the base a globe of tissue which has a diameter equal to that of the raised mid-rib. *Pleurisanthes flava* appears to be a rope-liana while *P. parviflora* appears to be more woody and have a more normal habit. Only the terminal shoots of *P. parviflora* are wiry and coiled. Ducke and Krukoff report the plant to be a vine.

Brazil: Near Livramento on the Rio Livramento, Municipality Humayta, State of Amazonas, *Krukoff 6954*.

The above collection is from the basin of the Rio Madeira in southwestern Brazil and is a great extension of the known range of the genus. *Pleurisanthes Artocarpi* Baill. and *P. emarginata* Van Tieghem are known only from French Guiana while *P. flava* Sandw. has been collected only in British Guiana.

The type specimens of *P. Artocarpi* and *P. emarginata* are unicates in the Paris herbarium and are not available for study at the present time. I can find no record of other collections of these unusual plants of the Guianas. The genus has been considered by Van Tieghem as the type of a distinct family. The merits of this proposal will be considered in the subsequent monograph of the genus.

OECOPETALUM Greenman & Thompson

Oecopetalum guatemalense sp. nov. Plate III.

Arbor usque ad 20 m. alta; trunco 30 cm. diametro; ramulis novellis sparse albis vel fulvis sericeo-pubescentibus vel subglabris; laminis foliorum ellipticis vel elliptico-oblongis latissimis infra medium 10–14 cm. longis 3.5–6 cm. latis, apice anguste acutis, basi subrotundatis, margine leviter revoluta integris, supra glaberrimis viridibus, subtus pallidioribus adpressis pilis malpighiaceis sparse ornatis, costas subtus prominentes et venas primarias prominulas 4–6 arcuatas gerentibus, petiolis 0.7–1.0 cm. longis; cymis axillaribus usque ad 2.5 cm. longe pedunculatis plus minusve sordide fulveque adpresse pubescentibus; calyce breviter campanulato 2.1 mm. longo, basi loborum 1.2 mm. diametro; lobis ovatis obtusis 1.0–1.2 mm. longis, 0.9 mm. latis, dense sericeo-pubescentibus, calyce fructifero ca. 1.5 cm. diametro 0.6–0.7 cm. alto incrassato explanato persistente; petalis oblongo-lanceolatis, 8 mm. longis, 1.7–2.0 mm. latis crassis carnosis extus sparse sericeo-pubescentibus intus glabris; staminibus 6.5–7.0 mm. longis; antheris oblongis

5–5.3 mm. longis 1.3–1.5 mm. latis, connectivo rufo-brunneo crasso; ovario et stylo glabro; fructu drupaceo globoso rugoso glabro fulvo-brunneo 1.8–2.0 cm. diametro; seminibus in loculo solitariis globosis anatropis; embryone in medio albuminis immerso curvato, cotyledonibus foliaceis ovatis, radiculam subaequantibus.

GUATEMALA: Finca Moca, Dept. of Suchitepequez, alt. 1140 m., tree 60 ft., 1 foot d.b.h., straight slender trunk with smooth brown bark, flowers white fragrant, nut in a fleshy cup from which it falls when ripe, Jan. 8, 1935, *Skutch 2080,* (TYPE, Arnold Arboretum, ISOTYPE N.Y.); Volcan Zunil, Dept. of Quezaltenango, alt. 1765 m., tree in virgin forest 40 ft. high, 1 foot d. b. h., flowers white, August 7, 1934, *Skutch 954* (A, N.Y.).

MEXICO: Finca Irlanda, Chiapas, June 1914, *Purpus 7609,* (A, G, N.Y., U.S., sub "Mappia").

The leaves of the Mexican collection are larger than the type but the characters are still distinctive.

Oecopetalum guatemalense is readily distinguished from *O. mexicanum* by its elliptical to elliptical-oblong leaves which are broadest below the middle and the bases of which are narrowed or subrotund but are not cuneate, its longer pedunculate inflorescences which approach 2.5 cm. in length, its oblong anthers only slightly narrowed at the apex and by its corolla which is more pubescent on the outside. This new species extends the range of the genus to Guatemala and represents the second species of the formerly monotypic genus.

The fruit of this genus has never been described. Contrary to the original description there are two ovules in the ovary, one with a short funiculus, and the second borne on a longer funiculus and placed directly under the first. In drying or under pressure these two ovules may become fused together but careful dissection shows that two are present. This condition is found in both species. Only one ovule develops. The mature fruit is a one-seeded drupe. The sarcocarp is glabrous and light brown and is coarse in texture. It contains masses of stone cells. The putamen is rugose giving a similar surface to the fruit. The single locule is smooth to slightly pitted inside containing a single pendulous, anatropous, globose seed with a thin testa. The embryo is located in the center of the albumen and is curved. The cotyledons are foliaceous and ovate. They are borne on stalks about one fourth their length. The cotyledons about equal the cylindrical radicle in length. The calyx enlarges in fruit, a condition exceedingly uncommon in the Icacinaceae and retains its green color. The drupe falls away from the calyx at maturity, and not with it, as is customary in the Icacinaceae.

GENERA TO BE EXCLUDED

METTENIUSA Karsten

Karsten (Fl. Columb. **1**: 79, t. 39. 1859) proposed the genus *Metteniusa* as the type of a new family near the Convolvulaceae or Boraginaceae and particularly near the genus *Cordia*. Engler (Nat. Pflanzenf. Nachtr. 226. 1893) places this genus in the Icacinaceae. In 1934, Sleumer (Notizbl. Bot. Gart. Berlin **12**: 148) described a new species of the genus *Aveledoa* Pittier of the Olacaceae and suggested its affinity with the Icacinaceae. Later in 1936 (Notizbl. Bot. Gart. Berlin **13**: 359) he combined this genus with *Metteniusa* which he placed in the Icacinaceae.

I have examined a co-type of *Metteniusa nucifera* (Pittier) Sleumer and also have the descriptions of the other species for study. On the basis of these it seems improbable that the Icacinaceae is the correct family for this genus. As figured by Karsten and described by Karsten, Pittier, Sleumer and verified by my own examinations the corolla has a tube approaching 1.2 cm. in length and lobes of 2.4–2.6 cm. long or a total corolla length of 3.5–4 cm. The corolla is described as twisted before anthesis and there is no mention in the text or indication in the figures of an inflexed corolla tip or of appendages. These developments are very different from those found in the Icacinaceae. A large tubular corolla 1.3 cm. long is found in *Leptaulus* but in no other species of the family known to me does the tube or entire corolla exceed 1 cm. in length. I have found no occurrence of corolla twisting in the Icacinaceae. A constant character of the Icacinaceae is the inflexed corolla tips which often bear broader appendages. There is no indication of this in *Metteniusa*. The stamens in *Metteniusa* are attached to the corolla-tube. The genus *Leptaulus* is the single genus in the Icacinaceae bearing the stamens attached to a definite corolla-tube. The anthers in *Metteniusa* are given as 1 cm. long on filaments 1.5 cm. long. In length this vastly surpasses anything found in the Icacinaceae. Karsten figures the lower ends of the anthers as free and recurving when mature which also has no counterpart in the Icacinaceae.

The filiform style of *Metteniusa* is about 2 cm. long while for comparison the longest style thus far encountered was about 7 mm. long in *Leptaulus*, perhaps a third of the length of that of the former plant. Apparently *Metteniusa* has the flowers attached to the pedicels without an articulation. The constancy of this articulation in the Icacinaceae is contrastingly significant as only *Pleurisanthes* and some of the Phytocreneae are without it. There are two bracts figured by Karsten immediately below the calyx and more further down the pedicel. There

is nothing comparable to this in the Icacinaceae. Finally, Karsten figures a curved embryo with foliaceous cotyledons and the only counterpart of that in the Icacinaceae is found in the group of genera with broad connectives to the stamens which lacks a parallel in *Metteniusa*.

I can offer no suggestion at this time concerning the proper position of this genus; however, it seems apparent to me it does not belong in the Icacinaceae.

POGONOPHORA MIERS EX BENTHAM

Pogonophora Schomburgkiana Miers ex Bentham in Hook. Jour. Bot. 6: 372. 1854.

Poraresia anomala Gleason, Bull. Torr. Bot. Club 58: 385. 1931; Sandwith, Kew Bull. 1935: 121.

Poraresia anomala is synonymous with *Pogonophora Schomburgkiana* earlier described by Miers. Mr. Sandwith had indicated this on the type sheet at the New York Botanical Garden Herbarium. The suggestion was also made that the genus *Pogonophora* might belong in the Icacinaceae. On the basis of the flower form, the internal structure of the wood, and the fruits, it appears to me that this genus is better left in the Euphorbiaceae where Bentham placed it. It certainly does not belong to the Icacinaceae.

EXPLANATION OF PLATES

All examples of staminate hairs are reduced in size and number. Sizes of all floral parts are taken from the mature bud condition unless otherwise stated.

PLATE I

Urandra lanceolata (Becc.) O. Ktze. (Haviland 1773). Figs. 1–6.

Fig. 1. Mature drupe with portion of the pericarp removed to show the fibrous nature. × 1.

Fig. 2. Pistil showing the membranaceous complete skirt at its base. × 14.

Figs. 3, 4, 5. Adaxial, lateral, and abaxial views of the stamens. Abaxial hairs bent over the anther in bud. × 12.

Fig. 6. Mature bud showing the loose calyx.

Stemonurus Bl. Figs. 7–15.

Fig. 7. A mature fruit of *Stemonurus* showing the umbilicate disk at the apex and the vascular ridge on the surface. × 1.7.

Fig. 8. Mature pistil of *S. axillaris* (Wall. ex Lindl.) Miers (Hook. f. and Thompson, Khasia), showing the enlarged apical ring of fleshy tissue with the depressed stigmatic surface. × 9.

Figs. 9, 10. Lateral and adaxial views of the sterile stamens from an open pistillate flower of the same. × 10.

Figs. 11, 12. Adaxial and lateral views of fertile stamens from an open flower of *S. apoensis* Elmer (Elmer 15416) showing the region of elongation in the filament between the internal hair cluster and the anther. × 8.5.

Fig. 13. Stamen of the same in bud condition to show the contrast. × 11.

Fig. 14. Pistillate rudiment from the staminate flower of the same. × 12.5.

Fig. 15. Pistillate rudiment from the staminate flower of *S. axillaris* (Hook. f. and Thompson, Khasia). × 15.

Lasianthera africana Beauv. (Coman 41). Figs. 16–22.

Fig. 16. Face view of fertile pistil showing the large appressed flap of the ovarian wall. × 20.

Fig. 17. Lateral view of the same. × 20.

Fig. 18. Face view of the pistil with the lobe of the ovarial wall removed. × 20.

Figs. 19, 20, 21. Adaxial, lateral, and abaxial views of stamens showing internal hairs attached to the lobe of the filaments as well as the quite broad filament. × 14.

Fig. 22. An adaxial view of a portion of the opened corolla showing the inflexed lobes and appendages, sutures present at the apex and the base but not at all evident in between. × 13.

Gastrolepis austro-caledonica (Baill.) Howard. (Franc 1791). Figs. 23–28.

Fig. 23. Face view of the pistil showing the small flap of the ovarian wall at the base. × 17.

Fig. 24. Lateral view of the same showing the lobe to be very fleshy but only slightly appressed. × 17.

Fig. 25. Lateral view of the mature fruit showing the asymmetry and appendage. × 2.5.

Figs. 26, 27. Lateral and adaxial view of the stamens of the same showing the absence of the internal lobe of the filament. × 15.

Fig. 28. Mature bud showing the distinct sutures of the corolla and the articulation with the pedicel. × 8.

Plate II

Cantleya corniculata (Becc.) Howard. (U. C. 265771 ex Herb. Hort. Bog.). Figs. 1–7.

Fig. 1. Pistil. × 12.5.

Figs. 2, 3, 4. Adaxial, lateral, and abaxial views of the stamens. × 7.5.

Fig. 5. Lateral view of the petal showing the inflexed tip. × 7.

Fig. 6. Adaxial view of the petal. × 7.

Fig. 7. A portion of the inflorescence axis showing the series of imbricated scales at the base. × 0.8.

Medusanthera glabra (Merr.) Howard. Figs. 8–15.

Figs. 8, 9. Lateral and face view of the pistil showing the basal gibbosity. (Wenzel 1744.) × 12.

Figs. 10, 11. Face and lateral views of the mature fruit. (Wenzel 1628.) × 1.5.

Fig. 12. Adaxial view of a fertile stamen. (Wenzel 1029.) × 10.

Fig. 13. Lateral view of the sterile stamen from a pistillate flower. (Wenzel 1744.) × 10.

Figs. 14, 15. Side and face view of the pistillate rudiment from a staminate flower. Notice the indication of a gibbosity. (Wenzel 1029.) × 1.

Gonocaryum Miquel. Figs. 16–20.

Fig. 16. Fertile pistil of *Gonocaryum*. (Wang 73190.) × 12.

Fig. 17. Pistillate rudiment from a staminate flower of *G. longe-racemosum* King. (Sargent, sine no.) × 14.

Fig. 18. View of opened corolla of same showing the petal sutures at the apex, the filaments fused to the corolla tube, and the anthers held away from the tube by the development of a small knob of tissue. (Arrow.) × 7.

Fig. 19. Abaxial view of the stamen removed from the corolla tube of the same. × 9.

Fig. 20. Bud of the same showing the sutures of the petals at the apex only. × 7.1.

Platea Blume. Figs. 21–27.

Fig. 21. Pistillate flower which is not articulated. (Elmer 10613.) × 8.

Figs. 22, 23, 24. Adaxial, abaxial and lateral views of stamens of *Platea parviflora* Koord. & Valet. (Brass 11564.) × 15.

Fig. 25. Pistillate rudiment from the staminate flowers of the same. Quite often this bears long hairs from the apex. × 12.

Fig. 26. Mature drupe of *Platea philippinensis* Merr. (Elmer 15264.) × 0.8.

Fig. 27. Dorsal view of expanded corolla of *P. parviflora* showing the short tube and two of the five stamens in place. (Brass 11564.) × 7.5.

PLATE III

Oecopetalum guatemalense Howard. (Skutch 2080.)

Fig. 1. Habit. × 0.5.

Fig. 2. Para-sagittal section of the ovary showing the two ovules placed one above the other. × 7.5.

Fig. 3. Mature fruit. × 1.2.

Fig. 4. Mature bud showing the articulation. × 3.5.

Fig. 5. Pistil. × 5.

Fig. 6. Laterial view of the petal. × 5.

Fig. 7. Adaxial view of the petal showing the lateral ridges. × 5.

Fig. 8. Fruit with mature calyx as seen from below. × 1.

Fig. 9. Diagrammatic cross-section of the seed showing the curved embryo included in the albumen. × 1.5.

Fig. 10. Malpighiaceous hairs found on the leaf. × 100.

Fig. 11. Embryo. × 1.2.

Figs. 12, 13, 14. Adaxial, lateral and abaxial views of stamens. × 6.

STUDIES OF THE ICACINACEAE

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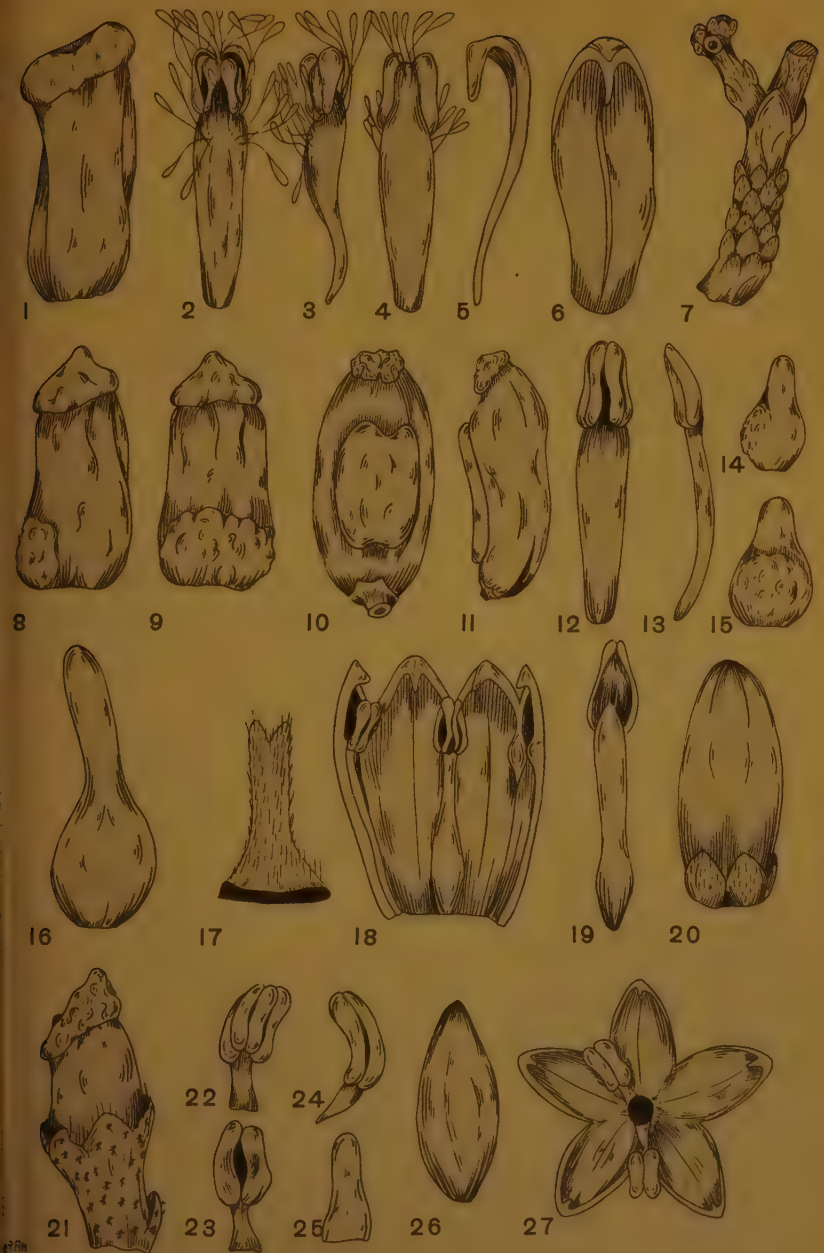

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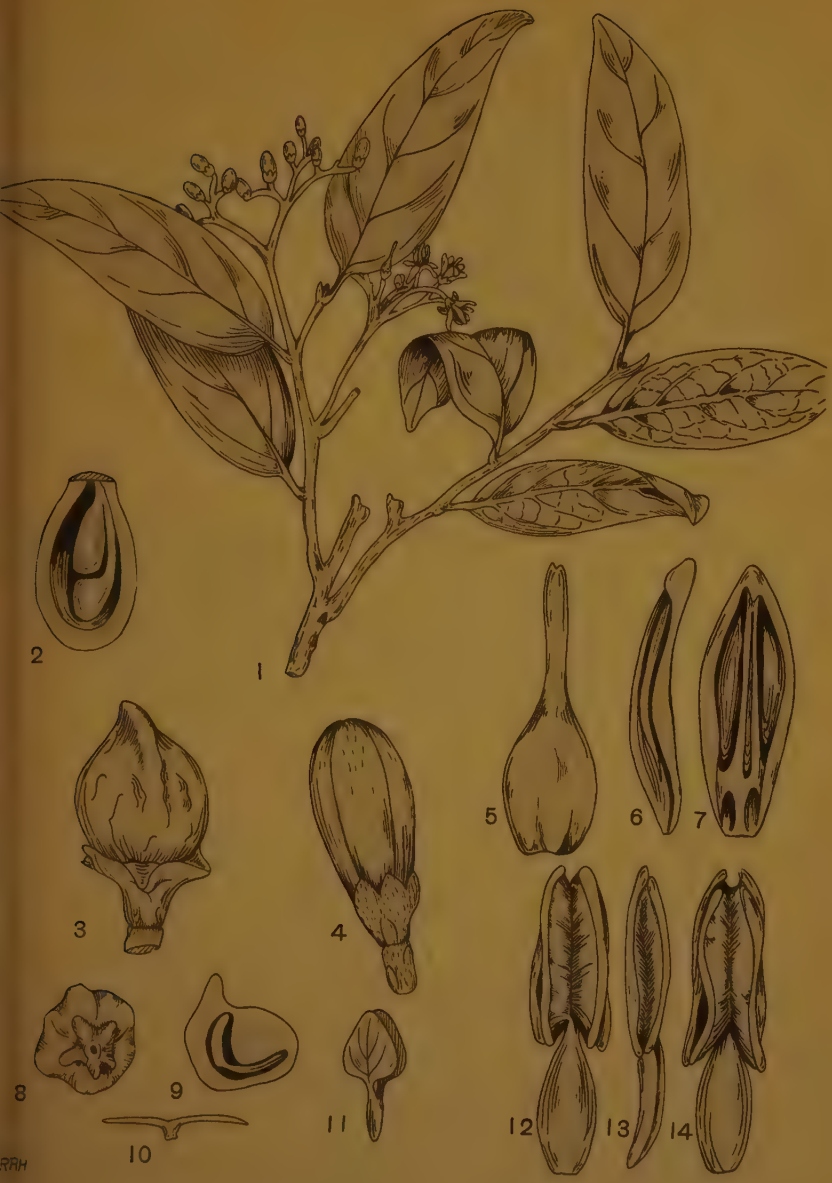

Studies of the Icacinaceae
Oecopetalum guatemalense Howard

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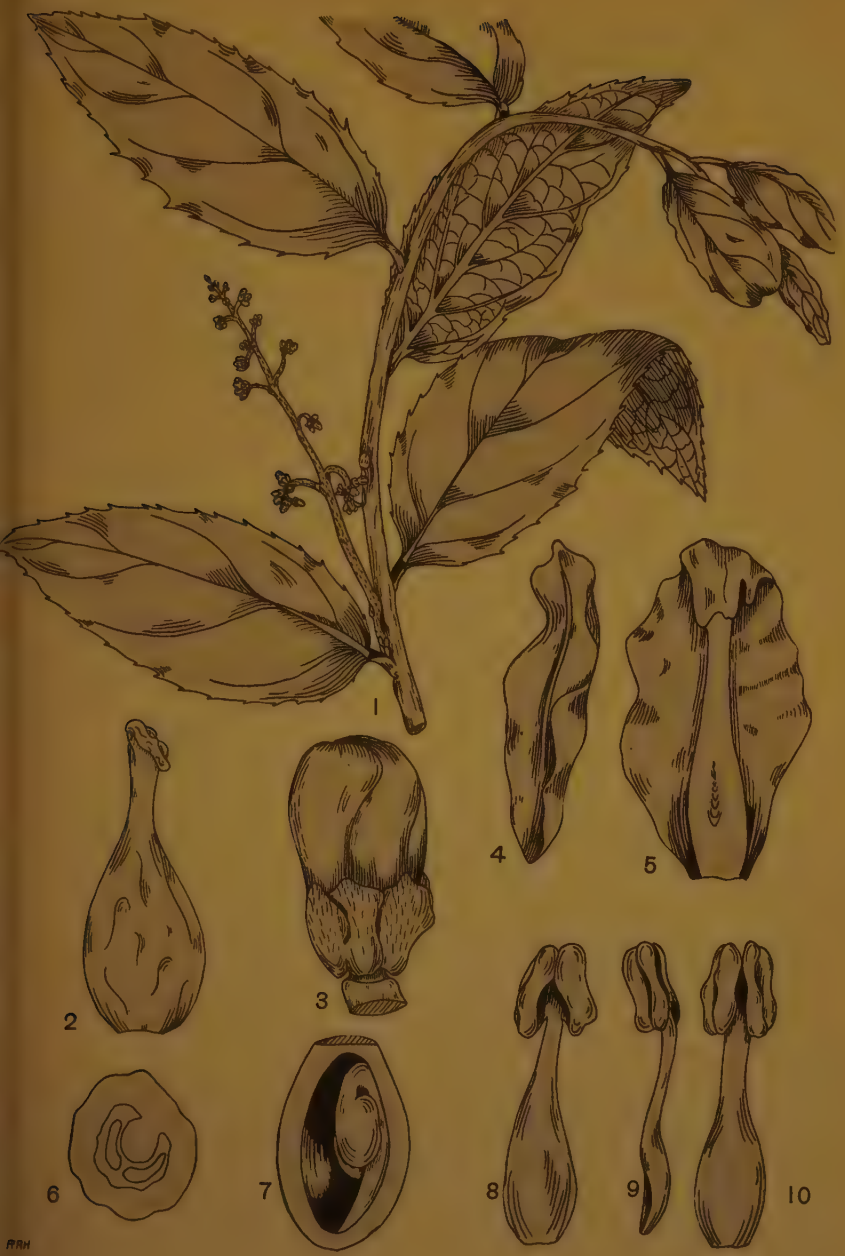

Studies of the Icacinaceae
Citronella peruviana Howard

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Plate IV

Citronella peruviana Howard. (Weberbauer 6617.)

Fig. 1. Habit. × 0.5.

Fig. 2. Pistil. × 17.

Fig. 3. Bud. × 11.

Fig. 4. Lateral view of the petals of a mature flower with the tip reflexed. × 8.

Fig. 5. Adaxial view of the petal showing the inflexed apex and raised mid-rib. × 10.

Fig. 6. Diagrammatic cross section of the ovary showing the projecting vascular supply and the two ovules.

Fig. 7. Para-sagittal section of the ovary showing the two ovules, one on each side of the internal ridge. × 13.

Figs. 8, 9, 10. Abaxial, lateral, adaxial views of stamens. × 16.

Gray Herbarium,
Harvard University.

NEW AND CRITICAL EUPHORBIACEAE FROM EASTERN TROPICAL ASIA

LEON CROIZAT

IN THIS PAPER is presented a selection of novelties, critical notes and transfers chiefly dealing with Chinese species. *Breyniopsis* Beille is reduced to *Sauropus* Bl.; a discussion of what constitutes a *nomen provisorium* is given in the note following the publication of *Croton Hookeri,* sp. nov. Lastly, notes on general issues of classification bearing upon *Euphorbia* in the Linnean sense appear in the treatment of *Chamaesyce pseudochamaesyce* (Fisch. & Mey.) Komar.

The material cited, specimens or fragments, unless otherwise specified, belongs to the herbarium of the Arnold Arboretum of Harvard University.

ACTEPHILA Bl.

Actephila inopinata, sp. nov.

Frutex ad 1.5 m. altus, pilis lanulosis in axillis atque ad alabastra perpaucis exceptis glaberrimus, subverticillatim ramosus. Foliis alternis, subverticillatis, firme membranaceis, integerrimis, pallide olivaceo-brunneis, concoloribus, ellipticis vel oblanceolatis, apice breviter acuminatis, basi cuneatis vel rotundatis, 8–3 cm. longis, 2.5–1.5 cm. latis, venis 4–5-jugis, obscuris, latissime patentibus, reticulatis, petiolo 0.5–1.5 cm. longo, stipulis late triangularibus ad 1.5 mm. longis. Floribus ♀ more generis longe pedunculatis, pedunculo capillaceo ad 3 cm. longo, divaricatim exserto; lobis in sicco purpureo-brunneis, ovatis, foliaceis, ca. 5 mm. longis, 3 mm. latis, venulosis, parallelinerviis; ovario glabro sessili ca. 3 mm. magno, stylis carnosulis ultra medium in stigmatibus 2 discretis partitis ca. 3 mm. longis, disco hypogyno in annulum ad 1 mm. crassum efformato. Caetera desiderantur.

HAINAN: Loktung, a shrub in dense woods, flowers greenish yellow. *S. K. Lau 27041,* June 1936.

The first species of the genus recorded for Hainan was *A. Merrilliana* Chun (Sunyats. 3: 26. 1935), which is characteristically pubescent, while *A. inopinata* is characteristically glabrous. *Actephila subsessilis* Gagn.,

from Indo-China, differs in the larger and less delicate floral and vegetative parts. The type specimen has only one flower, which discourages dissection and leaves undisclosed for the present the minute characters of the gynoecium.

SECURINEGA A. de Juss.

Securinega acicularis, sp. nov.

Fluggea leucopyrus sensu Hutchinson in Sargent, Pl. Wilson. **2**: 520. 1916, *saltem pro maxima parte. Non* Willd.

Frutex 2–6 m. altus, totus glaber, spinosus, aculeis (= ramulis abortivis) interdum apice dichotomis, cortice brunneo-discolori, ruguloso, minute lenticellato. Foliis anthesis tempore obcordatis, emarginatis, ad 7 mm. longis, 5 mm. latis, petiolulo 2–3 mm. longo fultis. Floribus in brachyblastis inermibus vel spinescentibus axillaribus, vulgo paucis fasciculatis (ca. 5 in fasciculo quove), ad 4 mm. latis, pedicello capilliformi rigidusculo ad 5 mm. longo fultis; lobis calycis ♂ obovatis vel ellipticis, costula carnosula, marginibus scariosis, 1.5–2 mm. longis, 1 mm. latis; staminibus 5, gracilibus, 3 mm. longis; pistillodio trifido, cruribus reflexis plus minusve clavatis, ca. 3 mm. longo; ♀ floribus fructibusque ignotis.

Western Hupeh: Patung Hsien, bush 2–6 ft., cliffs and rocky places, alt. 100–1000 ft., *Wilson 3336* (holotype, 2 sheets), *3335,* March 24, 1908; Wushan Gorge, bush 3–4 ft., *Wilson* (Veitch Coll.) *3344,* March 1908.

This plant does not closely resemble *S. leucopyrus* (Willd.) Muell. Arg. commonly found in the arid plains of India from Ceylon to Burma. *Securinega leucopyrus,* as shown by: *Leschenault 102,* Mts. de Cottalam sud de la peninsule de l'Inde; *Kanoth Yeshoda* 140, Hosur Taluk, South India; *Pierre s.n.* Galles, Ceylon; *Jacquemont 775,* in arenosis Hammerpoor; has ♂ flowers about one-half to one-third as large as those of the present species, borne in many-flowered, congested clusters with more or less flexuose pedicels, and resembles in habit the common *Securinega virosa.*

Securinega acicularis, S. leucopyrus and *S. virgata* (Poir.) Maire [*S. buxifolia* (Poir.) Muell. Arg.] are a closely knit phylogenetic group which ranges from Hupeh to Portugal and has some affinity with peculiar endemics of arid southwestern United States, namely, with *Halliophytum fasciculatum* Johnst. and its allies. The range: Iberian Peninsula - Central China is shared by other *Euphorbiaceae,* for instance by *E. isatidifolia* Lam. (N. E. Spain); *E. Wallichii* Boiss. (Himalayas,

Yunnan); *E. Pallasii* Turcz.,[1] which species are also related to *E. Darlingtonii* A. Gray (N. E. United States); and *E. ebracteolata* Hay. (Japan).

Hutchinson and other authors keep *Fluggea* and *Securinega* distinct. I accept instead the concept of Pax & Hoffmann who have reduced (Nat. Pflanzenfam. 19[c]: 60. 1931) the former to the latter. The group of genera around *Securinega* is in need of a fundamental revision.

GLOCHIDION Forst.

Glochidion silheticum (Muell. Arg.), comb. nov.

Phyllanthus silheticus Muell. Arg., Flora **48**: 378. 1865; DC. Prodr. **15**[2]: 297. 1866.— Hooker f., Fl. Brit. Ind. **5**: 327. 1887.

Hooker lists *P. silheticus* among the imperfectly known and doubtful species, and says "I do not recognize this" despite the fact that the type of the species is a specimen of his own collection. I could not trace this type in the Kew herbarium, but found in the herbarium of the Museum of Natural History of Paris a specimen, *Bradleia (9) Silhet J. D. Hook.*, determined by Mueller Arg. himself, which perfectly agrees with the description and, if not the holotype, is certainly an isotype.

This specimen, fragments of which were secured through the generosity of Prof. H. Humbert, agrees closely with two Chinese collections, namely YUNNAN: Szemao, forests 4500–5000 ft., tree 20 ft. spreading, red flowers, *Henry 11929, 11929A*.

Glochidion silheticum is closely related to *G. dasyphyllum* C. Koch, as Hara and myself have interpreted it (Jour. Jap. Bot. **26**: 317. 1940), and in a final revision of this obscure group may prove to be a synonym of this species. Attention is called upon our discussion of the generic validity of *Glochidion* (op. cit., 315).

[1] In a recent work on the Euphorbieae of Eastern Asia (Jour. Jap. Bot. **6**: 345. 1940), Hurusawa has preferred *E. Fischeriana* Steud. to *E. Pallasii* Turcz., mistakenly assuming that Turczaninov's publication of this binomial is a *nomen nudum*. This publication, on the contrary (Bull. Soc. Nat. Moscou **11**: 100. 1838) definitely refers to *E. verticillata* Pall. as synonym, showing that Turczaninov was aware of the previous publication of *E. verticillata*. Pallas himself did not publish *E. verticillata* but referred to this plant in herb. as *E. macrorhiza*. Turczaninov erred in attributing the authorship of the binomial to Pallas, but this *lapsus* has no vital bearing upon the fact that *E. Pallasii* Turcz. is a nomenclatural transfer, not a *nomen nudum*, which antedates the publication of *E. Fischeriana* Steud. by three years. The validity of the transfer effected by Turczaninov is recognized by Litvinov (Sched. Herb. Fl. Ross. **8**: 97–98. 1922), who, nevertheless, accepts *E. verticillata* Fisch. on the ground that *E. verticillata* Vell. and *E. verticillata* Desf. are "nomina abortiva." Litvinov's interpretation, of course, is not valid under the Rules of Nomenclature now in vigor.

Glochidion eriocarpum Champ., Kew Jour. Bot. **6**: 6. 1854.

Glochidion villicaule Hooker f., Fl. Brit. Ind. **5**: 326. 1887.— Handel-Mazzetti, Symb. Sin. **7**: 225. 1931, *pro maxima parte, syn. nov.*
Glochidion Esquirolii Lévl. in Fedde, Repert. **12**: 186. 1913.

I have seen the holotype of *G. villicaule* in the herbarium at the Botanical Garden at Kew. It is a specimen of Anderson, collected "at the Silver Mines," Burma, and it is identical with classic material of Champion's widespread and very common species; with *Handel-Mazzetti 5945* and with *Cavalerie 3536*, which last was determined by Beille as *G. velutinum*.

Glochidion velutinum of Beille and Gagnepain (in Lecomte, Fl. Gén. Indo-Chine **5**: 624. 1927) is a mixture of hairy species of *Glochidion* but is prevailingly based upon *G. eriocarpum*. One of the specimens cited by Beille, Tonkin: Yeng-khé, Bon (in herb. 1705. 1882), now in our herbarium, is an excellent sample of Champion's species.

Glochidion oblatum Hooker f., Fl. Brit. Ind. **5**: 312. 1887.

Bradleia 15 collected by Hooker & Thomson in Khasia and distributed without a Kew number, is the same as Griffith (Kew No. 4853), from the Sikkim Himalaya, the type of *G. oblatum*. This species is not uncommon in subtropical southwestern China. It is represented in our herbarium by: YUNNAN: mountains southeast of Mengtze, alt. 4000 ft., shrub 8 ft., *Henry 10755;* Nan-chiao, alt. 1450 m., 6 ft., in forest, *Wang 75205;* Fo-Hai, woody plant 15 ft., alt. 1540 m., *Wang 74218*.

The record is new for China.

BREYNIA Forst.

Breynia hyposauropus, sp. nov.

Frutex, habitu phyllanthoideo, totus glaberrimus; ramulis (scilicet: ramulis veris inflorescentiisque foliosis) in axillis stipularum triangulari-subulatis, singulis vel paucis fasciculatis. Foliis (revera bracteis foliaribus) vulgo 2 cm. longis, 1 cm. latis, ellipticis, membranaceis, supra brunneis, subtus griseo-glaucis, margine more generis integerrimis, apice basique rotundatis, venis simplicibus, tenuibus, 3–4-jugis, petiolo minimo, ad 1.5 mm. longo, basi stipulis 2 setaceis parvis armato. Floribus ♂ campanulatis, 2.5–3 mm. magnis, perianthio margine 5-lobulato, lobis rotundatis, columna staminali 3-dyma crassiuscula, ca. 2 mm. longa; floribus ♀ late campanulatis, ad 6 mm. latis, 3 mm. longis, lobis ovatis vel quadrangulari-ovatis, apiculatis, columna stylari 1.5–2 mm. longa, stigmatibus patentibus, more generis arcuatis. Fructu (Ching 6814) capsulari, ca. 1 cm. magno, epicarpio rufobadio, tenui, calyce vix accrescente.

KWANGSI: Loh Hoh Tsuen, Lin Yuin Hsien, "on slope, 1150 m., shrub with yellow flowers," *Steward & Cheo 434,* May 17, 1933; Tsin Hung Shan, N. Hin Yen, "shrub 3 feet, common, fruit orange yellow globular," *R. C. Ching 6814,* August 11, 1928. (LU).

Originally distributed either as *B. cernua* Muell. Arg. or as *B. rhamnoides* Muell. Arg., the present species differs from the former in the longer styles, in the larger capsule, in the differently shaped ♀ calyx, in the broader and longer leaves. It is much to be doubted that *B. cernua* reaches China or any of its islands; none of the Chinese specimens which I have seen determined under this binomial agrees with the holotype of *Melanthesa cernua* Decne. (?Riedlé : Timor) which is a full match of: *Neth. Ind. For. Service hb. 1785*: *Timor*, 1933 (optime! det. Van Steenis: *Breynia cernua* [Decne] Muell. (Arg.). *Breynia rhamnoides* (Willd.) Muell. Arg. has a very different ♀ calyx (*Perrottet, Pondichéry; Voigt, Serampore;* etc.) and larger leaves. *Breynia hyposauropus* is easily separated from *B. officinalis* Hemsl. (*Oldham 484*: Tamsuy, Formosa) by its much larger ♀ calyx and ♂ flower. It resembles *B. patens* (Muell. Arg.) Hook. f. [*Roxburgh*: *Phyllanthus patens; Wallich 7911 C; J.D.H. & T.T.*: *Mount Khasia*], but this last has larger and more acuminate leaves, and a much more accrescent calyx.

SAUROPUS Bl.

Sauropus Pierrei (Beille), comb. nov.

Breyniopsis Pierrei Beille, in Lecomte, Fl. Gén. Indo-Chine **5**: 630, fig. 75, 1–9. 1927.— Pax & Hoffmann, Nat. Pflanzenfam. **19**(c): 58. 1931.
Sauropus grandifolius sensu Beille, op. cit. 648. [*excl. planta yunnanensi et varietate*]. Non Pax & Hoffmann.

Beille separates *Breyniopsis* from *Breynia* (op. cit., 236. 1925) in a key, stating that *Breyniopsis* has spreading outer sepals and inflexed inner sepals while *Breynia* has all inflexed sepals. *Sauropus* is keyed by him separately with *Agyneia,* these two genera supposedly having sepals with a basal appendage that surrounds the androecium.

Pax & Hoffmann have voiced the suspicion that *Breynia* and *Breyniopsis* are synonymous (op. cit., 59) but, in this as in too many other cases, they have failed to secure authentic material to decide the issue. Fortunately, I have seen all the specimens of *Breyniopsis Pierrei* preserved in the Herbarium of the Museum of Natural History of Paris, and have secured for our herbarium: *Pierre 1792*: Cochinchina, Baochang 1877; *Poilane 2442*: same Province, without locality, 1925; *Evrard 110*: Cochinchina, Trang Bom near Bienhoa, which bear

Beille's own determination and have been cited in the original publication. Two other collections representing this same plant in our herbarium are: *Poilane 18173*: Annam, Mt. Nam Ray, Prov. Kontum, in a bamboo forest at 1800 feet; *Poilane 19566*: Cochinchina, on the road to the mountain-pass No. 20 near Song Lagna, prov. of Bienhoa.

Beille has determined and cited (op. cit., 648) as *S. grandifolius* Pax & Hoffmann, a specimen of Pierre from Cochinchina, s.l., which I am unable to separate from the specimens from the same region that are typic of *Breyniopsis Pierrei*. The true *S. grandifolius* is a plant of Yunnan, typified by a Henry collection from Szemao, which is hardly distinct from *S. longipedicellatus* Merr. & Chun from Hainan. This plant has little in common with the material from Cochinchina, which Beille treats as *S. grandifolius*, but fully agrees with: *Balansa*: Tonkin, Valley of Langkok, Mt. Bavi (*sic*); which Beille elects as the type of a trinomial, *S. grandifolius* var. *tonkinensis*.

It is not surprising that Beille himself should fail to extricate *Breyniopsis* from *Sauropus*. The limits between *Breynia* and *Sauropus* are as ill defined as those between *Glochidion* and *Phyllanthus*, *Mallotus* and *Macaranga*, *Croton* and *Julocroton*. These genera, in fact, are purely natural groups, which cannot be circumscribed. *Glochidion*, *Macaranga* and *Julocroton* rest upon tradition and intangibles; they are "good" in one region and "bad" in another; were they treated with the concept now ruling the classification of *Euphorbia*, they would barely be considered worthy of sectional rank. The belief that "good generic characters" exist which actually separated *Breyniopsis* from *Breynia* and *Sauropus* is grounded upon a misconception. *Breynia* and *Sauropus* may be kept separate as are kept separate, e.g., *Phyllanthus* and *Glochidion*, that is to say, for the sake of taxonomic convenience and of traditional values, but *Breyniopsis* cannot be rescued from synonymy, as it is practically identical with *Sauropus*. The phylogenetic background of the Euphorbiaceae is unlike that of other families, the Magnoliaceae for instance, a genus of which is prevailingly a clean cut dead-end of evolution. Every one of the major aggregates of the Euphorbiaceae, flows — as it were — into one or more others, and every one of them ultimately stands up or falls because it is intuitively perceived to be phylogenetically and systematically incompatible with its next of kin. On account of the peculiar evolution of the Euphorbiaceae certain characters are valuable for their classification which may not be at all important for the classification of other groups. The inflorescence, for instance, is relevant to a sound treatment of this family, which Bentham & Hooker have not failed to emphasize (Gen. Plant.

3: 241. 1883). Contrarywise, characters that are unimportant for the taxonomy of the Euphorbiaceae are of great moment for the classification of other families. Classification is a form of art, that is to say an intellectual activity which freely uses a few constant and fundamental principles, endlessly varying their application as the circumstances and the nature of things themselves dictate. *Breyniopsis* that relies for its separate status as a genus upon minor details of the style and of the calyx, if such indeed are not ephemeral, might, perhaps, stand up as a genus of the Olacaceae, of the Magnoliaceae, of the Celastraceae and the like. It conspicuously fails as a genus of the Euphorbiaceae.

Sauropus Delavayi, sp. nov.

Frutex minusculus, vix ultra 15 cm. altus, at bene lignosus, glaberrimus, caulibus hypogeis crassitie pennae anserinae vel digiti minoris, ramulis novellis vulgo quadrangulis, sub lente tenuiter alatis vel costulatis, levibus. Foliis orbicularibus vel quadranguli-orbicularibus, supra brunneis, subtus glaucescentibus saepius emarginatis, maximis 10–12 mm. longis, 6–8 mm. latis, crassiusculis, margine incrassatis, venis utrinque more *Phyllanti Urinariae* acerrimis, patentibus, sub margine laminae liberis, pluries dichotomis, petiolo crassiusculo vix 1.5 mm. longo, basi bistipulato, stipulis late triangularibus ca. 0.7 mm. magnis. Floribus ♂ minimis, in alabastro 0.3–0.5 mm. magnis; floribus ♀ 3 mm. latis, lobis late ovatis, carnosis, profunde partitis, quapropter imbricativis, ovario globuloso vix 1 mm. magno, stylis more generis adpressis, stigmatibus apice recurvis.

YUNNAN: without exact locality, *Delavay 2845*, ? 1887.

I believe that this is the specimen cited by Beille (in Lecomte, Fl. Gén. Indo-Chine 5: 655. 1927) under *S. orbicularis* Craib, from Yunnan, without name of collector, as the type of the new species secured from the Museum of Natural History of Paris, bears Beille's mss. determination: *S. orbicularis* Craib. This determination is an error, because *S. orbicularis* (*Kerr 2635*) is an altogether different plant, with leaves at least three times as large as those of the Delavay collection and of a very different texture and aspect. The new species is close to *S. concinnus* Coll. & Hemsl. (*Collett 818*) in the texture and size of its leaves, but this last has altogether different veins, which anastomose at the margins instead of ending in almost straight, free, and many-branched tips.

ANTIDESMA Burm. f. ex L.

Antidesma pseudomicrophyllum, sp. nov.

Frutex intricatim ramosus ad 3 m. altus, innovationibus pube adpressa

setulosa brunneo-discolori more generis indutis, vetustioribus glabris, griseis, rugulosis. Foliis pro genere minoribus, discoloribus, glaberrimis, integris, elliptico-lanceolatis, ligulatis, apice acuminatis vel sublineari-lanceolatis, 8–4 cm. longis, 1–0.8 cm. latis, venis tenuibus 6–8-jugis utrinque obviis, latissime patentibus subhorizontalibus, anastomosatis, petiolo 2–3 mm. longo. Fructu unico viso, ellipsoideo, complanato, 5 mm. longo, 3 mm. lato, nigro-brunneo, stigmate subterminali.

HAINAN: Po-ting, in forest, shrub 3 m., *S. K. Lau 28228,* November 1936.

Although the specimen is incomplete, it is clear that a form of the aggregate very indifferently classified in herbaria as *A. japonicum* S. & Z. is not involved. The Formosan endemic species of *Antidesma* are also excluded by manifest vegetative characters. *Antidesma microphyllum* Hemsley of southeastern China and northern Tonkin is the species that *A. pseudomicrophyllum* Croizat more nearly suggests, the difference being that in Hemsley's species the primary veins are distinctly ascending, while in the new species they are very broadly spreading, the anastomoses being arranged subparallel with the margins of the leaf.

CROTON L.

Croton Chunianus, sp. nov.

Frutex 2 m. altus, innovationibus pube fasciculata subsimplici setoso-scabridis. Foliis pallide brunneis, verticillatis, firme chartaceis, lanceolatis, apice cuspidato-caudatis, basi coarctato-repandulis, subintegris 12–3 cm. longis, 8–2 cm. latis, pilis facsiculatis secus nervum medium gracilem exceptis glaberrimis, venis ca. 10-jugis gracillimis, late patentibus, penninerviis, anastomosatis, reticulum laxum efformantibus, petiolo brevissimo, hispido ca. 0.5 cm. longo. Cymis brevibus, depauperato-paucifloris (an semper?) ad 6 cm. longis. Flore ♀ : pedicello hispido 3 mm. longo, lobis ellipticis acuminatis, margine subherbaceis, costulatis, integris, 2 mm. longis, 1 mm. latis, petalis exacte triangularibus, lobis dimidio brevioribus; ovario levi ellipsoideo, stylis 3 in columnam coalitis, apice breviter partitis, stigmatibus capitato-bilabiatis. Capsula globosa, levissima, coriacea, ca. 5 mm. magna. Caetera desiderantur.

HAINAN, Loktung, in dense woods, shrub 2 m. tall, *S. K. Lau 27012,* June 1936.

Very near *C. dongnaiensis* Gagn., which has less narrowly elliptic leaves and a tomentose lepidote capsule. It appears to belong in the sectional affinity of *C. Verreauxii* Baill., an Australian species which Baillon selected as the type of section GYMNOCROTON (Étud. Gén.

Euphorb. 356. 1858), but which Mueller Arg. unjustifiably reduced (DC. Prodr. 15^2: 620. 1866) to his own section EUCROTON.

Croton Merrillianus, sp. nov.

Frutex 1.5 m. altus, apicibus totis pallide ochraceo-tomentosis. Foliis elliptico-lanceolatis, longe acuminatis, basi coarctata subrotundatis, 14–4.5 cm. longis, 7–2 cm. latis, integris, suboppositis, verticillatis, supra nitidiusculis levissimis pallide cinereo-viridibus, subtus pube stellata modice conferta ochraceo-cinereis, venis ca. 9-jugis, utrinque obviis, adscendentibus, anastomosatis, trabeculis eminentibus; petiolo validiusculo tomentoso 3–1 cm. longo, stipulis subsetaceis ad 0.5 cm. longis, glandulis 2, ceraceis, substipitatis. Cyma quoad visa 3 cm. haud excedente, certissime longiora, tomentosa, ♂ tantum. Flore: staminibus ca. 15 inflexis, calyce 5 mm. lato, 2.5 mm. longo, lobis ellipticis ca. 2 mm. longis, 1 mm. latis, filamentis glabris nigris.

HAINAN, Po-ting, 900 ft., in forest, leaf lustrous above, *F. C. How 73181*, July 1935.

Although the type-specimen is incomplete, the generic disposition under *Croton* is made certain by the inflexed anthers, venation, by the glands at the apex of the petiole that are stipitate, by the pubescence, and by more intangible characters. I know of no species from eastern tropical Asia that can be said to be close to the present one. It might be that *C. Merrillianus* is related with *C. Hutchinsonianus* Hoss. and with the Indo-Chinese and Siamese species of the latter's affinity. *Croton Hutchinsonianus*, however, is subsilvery and, at any rate, more definitely tomentose than the present species.

Croton Hookeri, sp. nov.

Croton khasianus Hooker f., Fl. Brit. Ind. 5: 392. 1887, *in observ. sub C. Griffithii. Nomen provisorium.*
Croton laevifolius Hooker f., op. cit., 393. *Non* Blume.

I have so far seen only one Chinese specimen, namely: YUNNAN: mountains south of Szemao, 4500 ft., tree 20 ft., *Henry 12106*. The binomial proposed by Hooker for this entity is a *nomen provisorium* not allowed by the Rules of Nomenclature now in vigor.

Article 37 *ter* (Proc. Sixth Intern. Bot. Congr., 365–6. 1936) statutes: "A name of a taxonomic group is not validly published unless it is definitely accepted by the author who published it. A name proposed provisionally (*nomen provisorium*) in anticipation of the eventual acceptance of the group, or of a particular circumscription, position or rank of a given group, or merely mentioned incidentally is not validly published."

Hooker took up *C. laevifolius* Bl. for a Khasian plant of Wallich's collection, following the lead of Mueller Arg. (DC. Prodr. 15^2: 619. 1866), without having seen Javanese or Sumatran material. Then, in the publication of *C. Griffithii* sp. nov. he added, in a note: "A solitary specimen of Griffith's from Malacca (Kew Distr. 4799) has the very slender racemes of *C. laevifolius* and lepidote ovaries. It is possible that this is true *laevifolius* of Blume; and if so, the Khasian plant so called should bear the name of *khasianus*."

It is patent that what Hooker did was:

(a) To take up *C. laevifolius* Bl. for a Khasian plant, with question, which as such is a legitimate procedure.

(b) To propose for this plant a new binomial, *C. khasianus*, to be in force only *if* the cited specimen of Griffith from Malacca should prove to be *C. laevifolius* Bl., and not *C. Griffithii* or any other species.

Thus Hooker proposed *C. khasianus* in "anticipation of the eventual acceptance of the group," leaving it meanwhile to other taxonomists to decide whether this group had been covered or not by the earlier publication of *C. laevifolius*. In so doing, Hooker offered these taxonomists a *nomenclatural alternative* which might *automatically* be voided by the discovery that the cited specimen of Wallich was, indeed, *C. laevifolius*.

The fact that Hooker published a *nomen provisorium* to be possibly applied to the Khasian plant is flagrant, and this name cannot be used, as it originally appears, because a taxonomist who uses it violates Art. 37 *ter*. There may be a question whether I should legitimate *C. khasianus* under my own authorship, in order to preserve, somehow, the epithet of Hooker. The doctrine of legitimation of invalidly published circumscriptions is admittedly in need of elucidation. It is my personal opinion at present that any name, binomial or trinomial, published in *direct violation* of the word and spirit of an accepted article of the Rules cannot, and should not ultimately be healed by the action of another author. Validations of this nature involve at least an element of confusion and controversy in the citation of the valid binomial, as there is doubt now whether the primary author of the binomial is the validator or the validee. On the other hand, if the invalidly published name or epithet is allowed to lapse into the synonymy of a new, validly published one, no confusion of citation results, and the spirit of Article 37 *ter*, which *for just cause* forbids the use of *nomina provisoria*, is respected.

Croton Hookeri is very near *C. laevifolius* and there would be a serious question as to its being specifically distinct if the ranges were contiguous. The form represented by *C. laevifolius* is widespread in tropical eastern

Asia, and much critical study remains to be done before the species of this exceedingly difficult group are properly defined and understood.

Croton euryphyllus W. W. Smith, Not. Bot. Gard. Edinb. **13**: 159. 1921.

Croton Cavalerici Gagnepain, Bull. Soc. Bot. France **68**: 550. 1922.
Croton caudatiformis Handel-Mazzetti Anzeig. Akad. Wiss. Wien, **62**: 225. 1925; Symb. Sin. **7**: 217. 1931.

The synonymy is established upon types or classic specimens seen in the Museum of Natural History of Paris or available in our herbarium. *Croton euryphyllus* varies much in age and in season, and the differences which, according to Handel-Mazzetti, separate it from *C. caudatiformis*, are of no moment. *Croton euryphyllus* has the hard, large capsule of *C. caudatus*, but does not seem to be very near this species. It is not comparable with *C. Tiglium* L. The following are cited as illustrative specimens: YUNNAN: Mengtze, woods, alt. 4700 ft., tree 20 ft., *Henry 10867;* region of Tungshan, Yangtze Drainage Basin, east of Likiang, *Rock 10471*, 1923.

Croton yunnanensis W. W. Smith, Not. Bot. Gard. Edinb. **13**: 159. 1921. — Handel-Mazzetti, Symb. Sin. **7**: 218. 1931.

Croton Duclouxii Gagnepain, Bull. Soc. Bot. France **68**: 553. 1922.

This synonymy, like that of the preceding species, is established after comparison of types or of classic specimens. The following two collections are worthy of mention: YUNNAN: Yangtze watershed, District of Likiang, *Rock 3907*, 1923; SZECHUAN, north of Yenyuen, *Handel-Mazzetti 2794*, 1914.

Croton kongensis Gagnepain, Bull. Soc. Bot. France **67**: 555. 1921; in Lecomte, Fl. Gén. Indo-Chine **5**: 287. 1925.

This species appears to be very common in certain regions of southwestern tropical China. It is represented in our herbarium by the following collections among others: YUNNAN: Szemao, forests, alt. 4000 ft., shrub 8 ft., *Henry 12917, 12917A;* Chen-Kang-Hsien, alt. 2000 m., bush 5 m., common, *Wang 71705*, 1936; Tsang Yuan, alt. 1500 m., height 1 m., *Wang 73294*, 1936; Fo-Hai, alt. 975 m., woody plant 8 ft., *Wang 74615*, 1936.

The Yunnan plant is identical with that of Laos which was used to typify the binomial. The specimen cited by Gagnepain for Cochinchina: Mt. Din, *Pierre s.n.*, is possibly *C. argyratus* Bl., with which *C. kongensis* is easily confused.

The record is new for China.

MALLOTUS Lour.

Mallotus conspurcatus, sp. nov.

Frutex (e collectore), innovationibus pube stellato-pulverulenta badia detergibili mox decidua indutis. Foliis 16 × 12, 9 × 7 cm. magnis, firmis, subcoriaceis, ovatis, subintegris, breviter cuspidatis, bene peltatis, ad petioli insertionem glandulis parvis ad 6 notatis, supra brunneis, levibus, subtus indumento stellato rubro-brunneo, glandulis minutis luteo-ceraceis suboccultante, venis 5–8-jugis arctius adscendentibus, primo jugo in venulis ad 5 cm. longis utrinque ad marginem abeunte, quam media lamina multo longiore; petiolo tomentoso ad 9 cm. longo. Floribus ♂, ♀ ignotis. Inflorescentia sub fructu ad 15 cm. longa, capsulis congestis, globulosis, ad 1.5 cm. magnis, processibus filiformibus tomento stelligero indutis confertissime echinato-lanosis, pedicello vix 3–5 mm. longo. Semine ad 5 mm. longo, 4 mm. lato, testa verrucosa, arillo tenuiori badio tecto, hilo rapheque externo conspicuis.

Kwangsi, Pin-Lam, shrub in woods by hill, *S. P. Ko 55683,* September, 1935.

A species unlike any other known to me from continental China. It somewhat resembles an unnamed plant from Hainan, but this (*How 72987*) has manifestly tricoccous capsules with a thin indument and few flowered ♀ cymes.

Mallotus Metcalfianus, sp. nov.

Arbor 5–7 m. alta, innovationibus pube minuta stellata laete rubiginosa demum decidua indutis. Foliis 25 × 17 ad 11 × 9 cm. magnis, firme membranaceis, ovatis vel triangulari-ovatis, margine laxe dentatis ad subintegris, leviter peltatis, ad petioli insertionem glandulis 2–3 parvis notatis, supra glabris, brunneis vel badiis, interdum impresso-rugosis, subtus tomento confertissimo badio-rubiginoso indutis, glandulis ceraceis nullis, venis optime penninerviis 7–10-jugis, petiolis 5–10 cm. longis. Floribus ♂, ♀ ignotis. Inflorescentia ♀ sub fructu conferta valida ad 25 cm. longa, 5 cm. crassa, *Typhae* capitulum quemadmodum admonente, capsulis processibus stellato-tomentosis echinatis, ad 15 mm. magnis.

Tonkin: Tu-Phap, "arbre de 5–6 mètres de hauteur dans les bois," *Balansa 3320,* September 1886.— Kwangsi: Foo Lung, Sup Man Ta Shan, tree 7 m., in shaded and dense woods along streamside, *H. Y. Liang 69716,* July 16, 1937.

This plant is probably included in Gagnepain's concept of *M. ricinoides* Mueller Arg. as he cites (in Lecomte, Fl. Gén. Indo-Chin. **5:** 356. 1925) a Balansa specimen from Tu-Phap, without giving its num-

ber. The type has remained for a long time in our herbarium under Mueller's binomial and I have regarded it as an extreme form of that very variable species, unlike anything else collected from eastern tropical Asia. The Liang specimen has been eventually found to match the Balansa collection so perfectly as to leave no doubt that the very same plant occurs in Tonkin and Kwangsi, which provinces are known to form a single floristic domain.

Mallotus Metcalfianus is intermediate among three other species, namely, *M. tetracoccus* Kurz, *M. Lianus* Croiz., *M. ricinoides* Muell. Arg. It might be considered as a variety of any one of them if a broad concept of specific limits were to be followed. To follow such a concept is clearly not advisable in the present case as this would involve a general revision of *Mallotus* which largely consists of forms with a restricted range tending to merge gradually with one, or more of their nearest allies. *Mallotus Metcalfianus* has in fruit a much stouter and much closer ♀ inflorescence than *M. ricinoides,* differently colored indument and coarser vegetative parts; it differs from *M. Lianus* and *M. tetracoccus* in the much thicker indument of the capsule and in intangibles of the vegetative organs.

Croton mollissimus Geisel. which I have discussed in a previous note without having seen the type (Jour. Arnold Arb. **19**: 141. 1938) is correctly treated by Mueller Arg. (DC. Prodr. **15**^{2}: 964. 1866) as a synonym of *M. ricinoides*. The type of *C. mollissimus* shows that the Geiseler's note (Croton. Monogr. 74. 1807) "Flore masculi cum foemineis mixti" is the result of an error of observation, the young fruits that Geiseler saw "growing" on the ♂ cyme of *C. mollissimus* having been glued at mounting. It is to be assumed that the report that *C. mollissimus* is a Chinese plant is due to an error or to a confusion in the notes of the collector. *Mallotus ricinoides* is not endemic to China.

It gives me pleasure to dedicate this species to Prof. F. P. Metcalf, to whose intimate knowledge of the flora of southeastern China I am indebted for the elucidation of many controversial issues which could not be decided by the study of herbarium material.

Mallotus subjaponicus (Croiz.), comb. nov.

Mallotus tenuifolius Pax var. *subjaponicus* Croizat, Jour. Arnold Arb. **19**: 138. 1938.

Frutex speciosus (fide Handel-Mazzetti). Foliis subintegris, plerumque tricuspidatis, tenuiter tomentosis ad glabrescentibus, ad 18 cm. longis, 15 cm. latis, petiolo vulgo 10 cm. longo. Floribus ♂, ♀ ignotis. Cymis sub fructu ad 10–15 cm. longis, capsulis ad 1 cm. magnis, processi-

bus plus minusve tomentosis; semine ca. 5 mm. magno, columella fructu delapso 5–6 mm. longa.

? A *M. japonico* Muell. Arg. cymis integris, capsulis majoribus, indumento epicarpii molliore differt; a *M. tenuifolio* notis vegetativis, habitu inflorescentiae, habitatu dignoscitur.

Ad specimina classica addatur: S. ANHWEI: Chu-hwa-san, *R. C. Ching 2772* (L.U. H.K. 34055), in herb. Lingn. Univ.

The work now being done on the Euphorbiaceae of Fukien, Kwangtung, and adjacent provinces has demonstrated that it is advisable to elevate this variety to species. Its characters, critically studied on the background of *Mallotus* in the whole of southern China, with much additional material available, prove to be adequate for the presentation of an independent binomial.

Mallotus tetracoccus Kurz, Jour. As. Soc. Beng. **16**: 245. 1873.— Alston in Trimen Handb. Fl. Ceyl. **6**: 267. 1931.

Mallotus albus Mueller Arg., Linnaea **34**: 188. 1865 and DC. Prodr. **15**^{2}: 965. 1866, *saltem p.p.*— Hooker f., Fl. Brit. Ind. **5**: 429. 1887.— Pax & Hoffmann, Pflanzenr. **63**(IV. 147. VII): 168. 1914.— Gagnepain in Lecomte, Fl. Gén. Indo-Chine **5**: 353. 1925.— Croizat in Jour. Arnold Arb. **19**: 144. 1938.— Non *Rottlera alba* Roxb.

Alston has called attention to the fact that if Roxburgh's original specimen of *Rottlera alba* was from Penang, it could not typify *Mallotus albus* (Roxb.) Muell. Arg., but must be some other species, perhaps *M. barbatus*. Alston, accordingly, had reduced *M. albus* to *M. tetracoccus*.

The surmise of Alston is in the main correct. The isotype of *Rottlera alba* and Wallich 7818 E, in the herbarium of the Museum of Natural History of Paris, do not represent *M. albus* of Mueller Arg. and of the authors who have followed him. These two specimens belong to *M. paniculatus* (Lam.) Muell. Arg.: fragments kindly given by Prof. H. Humbert, director of the section of Phanerogamy of the Parisian Museum, are now preserved in our herbarium.

CLEIDION Bl.

Cleidion xyphophylloides, sp. nov.

Fruticulus (e collectore), innovationibus subfistulosis (i.e., medulla nulla, ligno duriusculo) glabris vel parcissime strigulosis. Foliis pro genere sat magnis, ad 30 cm. longis, 7–8 cm. latis, longe oblanceolatis, utrinque glabris vel subtus hinc inde pilis strigulosis perpaucis obsitis, margine distanter uncinato-denticulatis, dentibus apice callosis, venis camptodromis ad 12-jugis, basi in petiolum validum vix 5 mm. longum

brevissime coarctatis. Floribus ♂, ♀ ignotis. Capsulae coccis ad 1–1.5 cm. longis: epicarpio tenui, glabro, tenuissime rugoso, semine rotundato trigono, 8 mm. magno, brunneo, maculis ochraceis subleprosis marmorato; columella fructu delapso 1 cm. longa; pedicello ca. 12 mm. longo.

HAINAN: without locality, small shrub in dense forest, flower yellow, *C. Wang 34006,* September 17, 1933; without locality, small shrub in shade, flower yellow, *C. Wang 36745,* January 15, 1934.

Although the material is very scanty and the specimens have been distributed as *Trigonostemon* I feel quite certain that *Cleidion* is the genus involved. The cymes of *Trigonostemon* have a more delicate and diffuse habit than those of the present specimens; in addition intangibles of leaf texture and aspect tend to rule out that genus.

Cleidion Vieillardii Baill. and *C. macrophyllum* Baill., both from New Caledonia, are the species known to me that in vegetative characters more closely approach *C. xyphophylloides.*

EPIPRINUS Griff.

Epiprinus hainanensis, sp. nov.

Frutex ad 3 m. altus, foliis ad internodia verticillatim aggregatis, innovationibus pube velutinosa stellata pallide lutea totis tomentosis, demum glabris, cortice subochraceo. Foliis pallide ochraceis discoloribus, adultis firme membranaceis, glabris, novellis membranaceis pube tenui stellata adspersis, 12–5 cm. longis, 7–3 cm. latis, basi subauriculatis, margine integris revolutis, repandulis, venis ca. 7-jugis, elevatis, arcuato adscendentibus, obscure anastomosatis, nervo medio valido, petiolis velutino-tomentosis, crassis, 0.5 cm. longis, ad basim glandulis 2 magnis atris sessilibus obsitis. Cyma bisexuali, illam *Crotonis* mentiente, ad 5 cm. longa. Floribus ♂ in cymulis Urticacearum more vix 0.5 cm. magnis aggregatis, minutissimis, calyculo glabro vix 0.75 mm. magno, antheris 3, sessilibus. Flore ♀ sessili, calyce velutino, pallide luteo, 2.5 mm. lato, 1.5 mm. longo, laciniis praesertim sub fructu utrinque ad basim biglandulosis, apice discretis, fimbriatis, 1 mm. longis, 0.5 mm. latis; ovario velutino, globoso-pyriformi, ca. 2 mm. magno, stylis 3, papillosis, bifidis, iis *Malloti* simillimis. Capsula subglabra, pericarpio coriaceo, ca. 1 cm. magna, pedicello 5–7 mm. longo fulta. Caetera desiderantur.

HAINAN, Chung Ngo Shan (Ch'ang-kiang District), fairly common on dry, steep slope, sandy soil, rocky thicket, woody, erect; ht. 3 m., diam. 9 cm., *S. K. Lau 3291,* 1934; without exact locality, tree, 10 m.

high, in shady forest, ravine along stream, *H. Y. Liang 65325,* 1934; Yaichow, alt. 2400 ft., shrub in forests, in fruit, *F. C. How 70700,* 1933.

The bisexual cyme immediately distinguishes the new species from *Mallotus* which in vegetative characters it much resembles. The position and characters of the ♀ flower are altogether unlike those found in *Cleidion.* The characters of the ♂ flower and the bisexual cymes exclude *Macaranga.* The genus is new for Hainan, the nearest species, geographically speaking, being *E. Balansae* from Tonkin, which is a very different plant.

SAPIUM P. Br.

Sapium Laui, sp. nov.

Arbor 12 m. alta, tota glabra. Foliis membranaceis, elliptico-lanceolatis, longe acuminatis, basi subcuneato-rotundatis, margine integris, utrinque olivaceo brunneis haud glaucescentibus, 11–3 cm. longis, 6–2.5 cm. latis, venis tenuissimis ca. 10-jugis, primo jugo subtriplinervio, caeteris latissime patentibus, petiolo gracili 6.5–4.5 cm. longo, glandulis parvis patelliformibus primo intuito a lamina ipsa discretis. Cyma tantum ♂ visa, habitu subcomosa, conferta, sub lente acri, bracteis floralibus ovatis, longe aristatis vel acuminatis, axi florigero 1.5–2 mm. crasso. Floribus fasciculato-glomerulatis ad 5 in axilla bracteae cuiusvis, bractea ovato-setosa, seta ad 1.5 mm. longa, nectariis utrinque ellipticis, 2 mm. longis, 1 mm. latis, pedicello tereti haud clavato, 4 mm. longo, calyx ca. 1 mm. magno, antheris 2 globosis, 0.5 mm. latis.

HAINAN, Chim Fung near Fong Ngau Po Village, Kan-en District, *S. K. Lau 5498,* February 1935.

Sapium discolor Muell. Arg. as so far interpreted is a collective species with numerous local forms connected by intermediates. Compared with the type of *S. discolor* (*Wright,* Hongkong) *S. Laui* shows appreciable differences in the floral structure. The glands of *S. discolor* are only half as long as those of *S. Laui;* its floral bracts are bluntly apiculate while those of *S. Laui* are aristate, the cyme as seen under a moderate magnification having altogether different habit. Other differences in the vegetative parts are less striking, but they add weight to the belief that the present species is sufficiently unlike *S. discolor* to deserve segregation.

EUPHORBIA L.

Euphorbia hainanensis, sp. nov.

Frutex totus glaberrimus, 1 m. altus, innovationibus herbaceis fistulosis. Foliis integris tenuiter membranaceis, ellipticis, supra brunneo-viridibus, subtus discoloribus, apice rotundatis rarissime subemarginatis,

basi cuneatis subverticillatim congestis, 7–3 cm. longis, 2–1 cm. latis, nervo medio carnosulo validiusculo, venis ca. 4-jugis, subtus obsoletis, supra graciliter reticulatis, petiolo herbaceo 3–2 cm. longo, basi stipulis glandulosis obsoletis obsito. Inflorescentiis unifloris, ramos steriles (an tantum?) anthesi peracta e basi pedunculi edentibus. Cyathio exacte obconico, ca. 4 mm. magno, pedunculo 4 mm. longo in involucrum evadente, nectariis (glandulis) 3, 2 mm. latis, 1.5 mm. longis, pallide luteis, carnosis, ellipticis ad subreniformibus, margine integro omnino exappendiculatis; lobis quadrangularibus, ca. 2 mm. magnis, dorso carinatis, margine levissime ciliato-erosulis; ovario levissimo subgloboso, stylo 5 mm. longo, ad apicem breviter 3-partito; stigmatibus ca. 1 mm. longis, gynophoro valido sub fructu longe exserto, 7–5 mm. longo, reflexo, capsula ovoideo-trigona, ca. 6 mm. magna, semine immaturo globuloso, testa levi, 3 mm. magno, caruncula videtur nulla.

HAINAN, Loktung, shrub in dense woods, 1 m. tall, *S. K. Lau 27036,* June 1936.

A strongly characterized species, probably related to *E. sessiliflora* Roxb. and *E. Lacei* Craib from eastern tropical India, Siam and Indo-China, and to *E. Ridleyi* Croiz. (*E. Synadenium* Ridl.) from Penang. The new species may also be near *E. Brownii* Baill. and *E. corynocladia* F. v. Muell. from Northern Australia. Its affinities with *E. plumerioides* Teijsm. require further study. The group formed by the species mentioned has a relationship with species from Madagascar and adjacent islands (*E. pyrifolia* Lam., *E. Abbotii* Balf., etc.) but none with the strictly Asiatic phyla of the genus.

Euphorbia Milii Ch. des Moulins in Bull. Hist. Nat. Soc. Linn. Bordeaux **1:** 27–30, pl. 1. 1826.— Desfontaines, Cat. Pl. H. Paris, edit. 3, 475. 1829.

Euphorbia splendens Bojer ex Hooker, Bot. Mag. **56:** t. 2902. 1829.— Denis, Euphorb. Iles Austr. Afrique 82 (Rev. Gén. Bot. **34:** 114) 1922.

Nothing can be done to rescue Bojer's well known binomial from synonymy. Denis' comment (op. cit. **83:** 115) on the uselessness of reinstating the overlooked binomial of Charles des Moulins may suggest to its reader that the original publication of this binomial is in some manner inadequate or controversial. This is not the case; the description is excellent and very detailed, with text both in Latin and French and an illustration. *Euphorbia splendens,* moreover, was reduced to *E. Milii* by Desfontaines the very same year W. J. Hooker announced it.

Specimens determined as *E. splendens* or *E. Bojeri* (which last Denis does not consider as a distinct species) are preserved in several classic herbaria, but it is not known whether any of these specimens has holotypic status. The plants of this group are exceedingly polymorphous and the publications of their binomials were made from cultivated specimens, which, barring uncontrovertible evidence to the contrary, leaves the first given description and illustration as the type. No attempts ever seem to have been made to trace the material that may be preserved in the herbarium of des Moulins. *Euphorbia Milii* does not belong to sect. DIACANTHIUM.

The species of this affinity are being cultivated throughout the world as favorite ornamental plants and in some tropical countries they tend to become established as escapes. Under the binomial of Bojer they are listed in Asiatic floristic work (e.g., in Gamble, Fl. Presid. Madras **7**: 1278. 1925) as introduced or adventitious.

Euphorbia Milii is almost certainly an ecospecies in the sense of Clausen, Keck & Hiesey (Carnegie Inst. Washington Publ. No. **520**: vii etc. 1940), with many ecotypes and races, which are likely to be accepted sooner or later as taxonomic subspecies. *Euphorbia Bojeri* and *E. Hislopii* N. E. Br. are two of such ecotypes, while at least some of the species proposed by Drake del Castillo, for instance: *E. rubrostriata, E. melanacantha, E. platyacantha,* are apparently not better than races in the Turessonian sense.

CHAMAESYCE S. F. Gray, emend. Croiz.

Chamaesyce pseudochamaesyce (Fisch. & Mey.) Komarov, Opred. Rast. D. V. K. 286. 1925.

Chamaesyce humifusa (Willd.) Prokh., Bull. Acad. Sc. URSS, sér. 6, **21**: 195. 1927; Consp. Syst. Tith. Asiae Med. 16. 1933., *quoad plantam asiaticam, pro maxima parte.*

Euphorbia pseudochamaesyce Fisch. & Mey., Ind. Sem. Hort. Petrop. **9**: 73. 1843.— Litvinov, Sched. Herb. Fl. Ross. **8**: 95. (no. 2575) 1922.

Euphorbia humifusa Auct. fl. sin. *pro maxima parte.*

The differences of the testa are emphasized by Litvinov as the fundamental difference between *C. humifusa* and *C. pseudochamaesyce.* This may not be true in every case, but it is certain, nevertheless, that the Far Eastern plant is not like the plant of Hungary and Central Europe. The asiatic plant has a more robust habit, larger leaves and a somewhat larger capsule. I have cultivated the true *C. humifusa,* that is to say, the Central European and Hungarian plant [= *E. humifusa* Willd.]

and *C. pseudochamaesyce* from northern China side by side for four years and have reached the conclusion that these differences are constant and not negligible. Parallel forms, which are similar and yet quite distinct, frequently occur in *Euphorbia* sensu lato (e.g.: *E. segetalis* L., *E. portlandica* L., *E. azorica* Steud.; *E. Terracina* L., *E. obliquata* Forskh.) and the classification of these groups has been handled very differently by different taxonomists. In the present case it is convenient to follow Komarov and Litvinov in granting specific rank to the binomial of Fischer & Meyer, not less on phytogeographical grounds than as a preliminary step towards the classification of the large group of species to which this binomial belongs. While it is likely that *C. pseudochamaesyce* and *C. humifusa* are not distinct ecospecies, and that the former is merely an ecotype of the latter, *sensu* Turesson and Clausen, Keck & Hiesey (Amer. Jour. Bot. **26**: 103–6. 1939), it remains to be seen whether the concept of coenospecies and its subdivisions may be usefully applied to the taxonomic treatment of plants *which range all over two continents.*

In the last four years I have found no reason to alter my opinion that the segregation of *Chamaesyce* from *Euphorbia,* which I have effected with an emended description (in Degener, Fl. Hawaii., December 9th, 1936) is necessary as a preliminary to a better classification of the Euphorbieae. Sherff's bold footnote (Ann. Missouri Bot. Gard. **25**: 2. 1938) and his more sober comments of a later date on this segregation (Bull. Torrey Bot. Club **67**: 377. 1940) are not adequate ground for a scientific discussion. The age-old statement that the characters used to segregate *Chamaesyce* from *Euphorbia* are merely vegetative habit (Haber, Ann. Bot. **39**: 702. 1925, etc.) has been repeated by Hurusawa (Jour. Jap. Bot. **26**: 333. 1940) in the very recent past. This statement is based upon a fundamental misconception of what constitutes habit and upon the confusion of *habit* induced by edaphic factors with *habit* that depends upon anatomical and phyletic specialization. Von Veh found (Ann. Jard. Bot. Buitenz. **38**[2]: 155. 1928) that the "leaves" of *Chamaesyce* are homologous with the floral bracts of other Euphorbieae. Gaucher who has made the most complete investigation of the anatomy of Euphorbiaceae so far available clearly states (Ann. Sci. Nat. 8 sér. **15**: 293. 1902) his conviction that great anatomical differences separate *Chamaesyce* from the other species of *Euphorbia,* which differences are associated with weighty morphological characters. Gaucher presents *Chamaesyce* as a subgenus of *Euphorbia* remarking that he does so only because the floral structure of the Linnaean genus is very constant. The cyathium, of course, is as constant as a floral structure as the

capitulum of the Compositae, which inflorescence is not used by modern taxonomists to bring together all the genera of this family that resemble each other. In groups in which definite and strongly marked anatomical specializations take place in the stem and in the leaves (Cactaceae, Euphorbiaceae, Aizoaceae, Geraniaceae, etc.) a sound classification cannot restrict itself to an artificial selection of "floral" characters, neglecting other basic phylogenetic data.

If *Chamaesyce* is to be treated as a section or as subgenus of *Euphorbia* it is made imperative by the very concepts that suggest this lumping that *Croton, Codiaeum* and *Julocroton; Mallotus* and *Macaranga; Glochidion* and *Securinega; Stillingia* and *Sapium; Synadenium, Monadenium, Diplocyathium,* and *Euphorbia* are lumped together. A clear understanding of generic conceptual limits and of the need of the classification of the whole family is required to end the confusion in the taxonomy of *Euphorbia* of which Pax & Hoffmann rightly complain (Nat. Pflanzenfam. 19[c]: 209. 1931). A mere shift of subgenera, sections and the like, leaving at the same time, the old confused concepts to rule the field of classification of the Euphorbieae serves no useful purpose. The question is not that of liking or disliking "smaller generic units." *Chamaesyce* is not a small unit; it numbers about 600 species, that is to say one-third of the total of the species of *Euphorbia* sensu lato, which genus is one-fourth of the Euphorbiaceae, this family in its turn being fifth by order of importance among the Phanerogames. The question involved here is one that cuts deep into the very fundamentals of systematic botany and taxonomy and must be faced with a clear understanding both of the uselessness of effecting partial transfers based upon unsupported or ill-informed opinion and of the damages caused to botany by preconceived tenets. It is to be regretted that the preferences of local botanists, who are normally familiar with but few of the species out of the Linnean genus, cannot be considered in working out the classification of the Euphorbieae which are a pandemic aggregate of about 2500 species.

Work is now in progress to define and segregate the remaining major units of *Euphorbia* L. sensu lato. The genus, as now understood, falls in three main units of which *Chamaesyce* is one. A large body of opinion holds to the belief that *Euphorbia* in the Linnean sense should be broken up altogether and at the same time or not at all, and refuses to accept the validity of segregates which are effected without complying with this belief. It is sound taxonomy, undoubtedly, to accept novelties after a careful consideration of their truth and advantages. It is not to be easily understood, however, why the taxonomy and the

systematic of the Euphorbieae should be ruled by beliefs and conditions which have never been voiced, and even less enforced, in the segregation of Compositae, Rubiaceae, Leguminosae and, generally speaking, of all large or fairly large groups. The history of these groups is a long and continuous record of partial excisions and ablations from the bloated body of Linnean concepts. The account of *Glycine* L. given by Merrill (Comm. Lour. Fl. Cochin. [Trans. Amer. Phil. Soc., **24:**] 208. 1935) is particularly instructive.

As illustrative specimens of *C. pseudochamaesyce* the following collections may be listed.

YUNNAN: Huann-fu-ping, A-tun-tze, alt. 3400 m., grassy slope, *Wang 69133* (a somewhat critical specimen to be compared carefully with Indian material of allied species).—KANSU: Yao-Kai, near Lichen, alt. 1825–2500 m., *R. C. Ching 256,* 1924.—NORTHERN CHINA: vicinity of Peiping, *David 21,* 1865.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

PLANTAE PAPUANAE ARCHBOLDIANAE, IV*

E. D. Merrill and L. M. Perry

ZYGOPHYLLACEAE

Tribulus Linnaeus

Tribulus cistoides L. Sp. Pl. 387. 1753; van Steenis, Bull. Jard. Bot. Buitenz. III. **13**: 105. 1933.

British New Guinea: coast between Oriomo and Fly Rivers, *Brass 6469* (common prostrate shore plant).

This is the first record of this pantropic species from New Guinea; van Steenis gives its detailed range in other parts of Malaysia.

SAPINDACEAE

In a large measure the species of the Sapindaceae represented in our collections are included in Radlkofer's monograph, Pflanzenr. 98(IV. **165**): 1–1539. 1931–33; nevertheless, with only scanty herbarium material for comparison, we have not found it an easy matter to name our specimens from this cumbersome work. In several instances it has been necessary to try to match staminate collections with brief descriptions of fruiting specimens; another handicap, in some genera, has been the emphasis placed at times on anatomical differences rather than those of gross morphology. The relatively small percentage of novelties found are recorded here, together with a few range-extensions.

Allophylus Linnaeus

Allophylus leptococcus Radlk. Sap. Holl.-Ind. 17, 56. 1877; Pflanzenr. 98a(IV. **165**): 581. 1931.

Solomon Islands: Guadalcanal Island, Berande, *Kajewski 2416* (a vine climbing rain-forest trees; fruit 9 mm. long, 6 mm. diameter, orange when ripe, sometimes in pairs, balloon shaped with a short neck).

Previously reported from the Key Islands and the Philippines.

*(Botanical Results of the Richard Archbold Expeditions) See Jour. Arnold Arb. **20**: 324–345. 1939; op. cit. **21**: 163–200, *t. 1.* 1940; op. cit. 292–327.

Lepisanthes Blume

? Lepisanthes palawanica Radlk. Leafl. Philip. Bot. **5**: 1604. 1913, Philip. Jour. Sci. Bot. **8**: 445. 1913; Merr. Enum. Philip. Fl. Pl. **2**: 500. 1923; Radlk. Pflanzenr. 98c(IV. **165**): 741. 1933.

With only meager material for study (an isotype with a very poor sample of fruit, a staminate collection and a pistillate one), at present we are unable to resolve the problematic position of this Philippine entity. Radlkofer placed it doubtfully in the genus *Lepisanthes*. His description indicates that he saw only a fruiting specimen, apparently with the fruit separated from the infructescence-axis. We find that the flowers are pedicellate rather than sessile, and closely resemble those of *Hedyachras* Radlk. (only staminate ones available for examination); they differ from the latter chiefly in the more or less pubescent disk and the non-retuse apices of the anthers. The obvious floral characters of ?*Lepisanthes palawanica* Radlk. might be summed up as follows: calyx 4–6-parted, valvate or very narrowly imbricate, tomentose outside, ± pubescent within (showing the imprint of the stamens), finally reflexed; petals none; disk ± pubescent, filaments glabrous (very short in ♀ flower); ovary compressed-ovoid, 2-loculed; style short, somewhat pubescent, the apex slightly enlarged and stigmatic.

The following collections differ from the Philippine material only in the slightly larger and perhaps more coarsely pubescent flowers: BRITISH NEW GUINEA: Lower Fly River, east bank opposite Sturt Island, *Brass 7980, 8058*, October 1936, rain-forest, a small substage tree on ridges; *Brass 8074* (weak branching tree 3 m. high, on river bank; flowers green).

Guioa Cavanilles

Guioa oligotricha sp. nov.

Arbor parva, ± 5 m. alta; ramulis teretibus, glabris, innovationibus fulvo-pubescentibus; foliis abrupte pinnatis; petiolo 2–2.5 cm. et rhachi 4–5 cm. longis, novellis fulvo-hirtellis; foliolis 4–6, alternis vel suboppositis, anguste ellipticis, utrinque angustatis (acutis), vel inferioribus ovatis, 5.5–9 cm. longis, 2.5–4 cm. latis, petiolulatis (petiolulis 3–5 mm. longis, basi incrassatis), pellucido-punctatis, chartaceis, integerrimis, supra olivaceis, praeter costam pubescentem glabris, subtus pallidioribus, parce ac consperse pilosulis, venis primariis utrinque 7–10, patenti-adscendentibus ad marginem arcuatis, subtus prominulis; paniculis axillaribus, brevibus (in fructu 3–6 cm. longis); rhachi ac ramulis hirtellis; floribus pedicellatis; sepalis glabris, ciliatis, vix 2 mm. longis;

petalis brevioribus, ± spathulatis, intus supra unguem squamulis 2 obtusis linearibus curvatis villosulis quam lamina paullo longioribus auctis; disco annulari, subaequali, sublobato, glabro; staminibus basim versus breviter parceque pilosis, antheris breviter ellipsoideis, connectivo ± fusco; ovario minuto, trigono, glabro; capsulis circiter 1.5 cm. latis, 0.8 cm. longis, glabris, divaricatim 3-lobatis, lobo uno alterove inani abbreviato, seminiferis oblique rotundatis a lateribus compressiusculis; semine arillo obtecto.

British New Guinea: Gaima, Lower Fly River (east bank), *Brass 8290* (type), November 1936, light rain-forest (shapely small tree 5 m. high; leaflets grey underneath; fruit smooth, red).

This species is closely related to *Guioa acutifolia* (F. v. Muell.) Radlk. The latter, however, is a glabrous plant with larger and fewer leaflets, and longer petiolules; the lobes of the capsule have a very narrow compressed margin, and the stipe broadens quickly below the lobes. In *G. oligotricha,* the leaflets have a shorter base and in the basal ones tend to be rounded; the lobes of the capsule are rounded evenly at the margin, and the stipe is narrower at the apex, thus giving the impression of a fruit with a longer stipe than that of its relative.

Guioa eriantha sp. nov.

Arbor; innovationibus puberulis; foliis abrupte pinnatis; petiolo 4–6 cm. et rhachi 4–7 cm. longis, puberulis vel glabratis; foliolis 4–5, oppositis, ellipticis, 7–11 cm. longis, 3.5–5 cm. latis, utrinque obtusis vel basi breviter cuneatis, integerrimis, petiolulatis (petiolulis ± 1 cm. longis, basi tumescentibus), juvenilibus chartaceis, adultioribus subcoriaceis, glabris; venis primariis utrinque ± 10, patentibus, marginem versus ± arcuato-anastomosantibus, secundariis etiam manifestis, fere parallelis, venulis subtiliter reticulatis; paniculis terminalibus, ad 20 cm. longis; floribus pedicellatis (pedicellis 3 mm. longis, dense puberulis vel brevissime pubescentibus); alabastris 2–3 mm. longis latisque; sepalis 5, anguste imbricatis, adpresse puberulis, ciliatis, exterioribus ± rotundatis, 1.5 mm. longis, interioribus ellipticis, 2.5 mm. longis; petalis 5, ellipticis, basi unguiculatis, 3.5 mm. longis, apice obtusis, extus dense adpresseque villosiusculis, intus basim versus pilosis, squamulatis, squamula extus villosa, apice emarginata vel retusa; disco annulari, sublobulato, puberulo; staminibus 8, filamentis villosiusculis, antheris glabris, basi excisis, connectivo rubro-fusco; ovario rudimentario minuto (0.5 mm. longo), obcordato-trilobo; fructibus ignotis.

British New Guinea: Lower Fly River, east bank opposite Sturt Island, *Brass 8244* (type), October 1936, rain-forest substage (tree of drier ridges; flowers white).

The species suggests *Guioa dasyantha* Radlk. It differs in the obtuse glabrous leaflets, the terminal inflorescence and the large scale on the petal. The upper part of this scale is so villous that it is not easy to determine whether the apex is shallowly lobed, retuse, emarginate or entire. The flowers (♂ only) are very young, only a few having yet reached early anthesis.

Guioa melanopoda sp. nov.

Arbor 8–15 m. alta; ramis teretibus, glabris, innovationibus puberulis; foliolis abrupte pinnatis; rhachi puberula, 5–11 cm. longa, sursum anguste alata, inferne petiolo nudo terete, 4–5 cm. longo; foliolis 6–8, subsessilibus vel breviter petiolulatis (petiolulis 2–4 mm. longis, in sicco nigro-fuscis, rugosis ac basi leviter tumidis), oppositis vel alternis, late lanceolatis vel oblongis, 9–17 cm. longis, 3–5.5 cm. latis, interdum paullo inaequilateralibus ac leviter curvatis, basi subobliquis, cuneatis, apice acute acuminatis (acumine 1–1.5 cm. longo), subcoriaceis, integerrimis, glabris vel in costa puberulis, minute ac dense pellucido-punctatis, venis primariis utrinque ± 10, arcuato-adscendentibus, supra impressis, subtus prominentibus; paniculis axillaribus, brevibus, petiolos paullo superantibus, a basi ramosis vel interdum fasciculatis, fulvo-puberulis; sepalis glabris, ciliatis; disco sub fructu relicto annulari, leviter inaequali, glabro; capsulis obcordato-trilobatis, 1 cm. longis, 1.3–1.5 cm. latis, breviter stipitatis (stipite 3-angulari, 1.5–3 mm. longo), stylo brevi apiculatis; lobis seminigeris lateraliter compressis, margine obtusis; semine arillo obtecto.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13699* (TYPE), March 1939, alt. 850 m., seral rain-forest of river banks (tree 8 m. high; fruit red); 6 km. southwest of Bernhard Camp, Idenburg River, *Brass 12783*, February 1939, alt. 1200 m., rain-forest substage (tree 15 m. high).

Superficially the species resembles *Guioa pleuropteris* (Blume) Radlk., but the specimens are less pubescent; the leaves have more primary veins; the calyx is glabrous, and the disk, although a little thicker on one side of the fruit than on the other, is annular.

Guioa crenifoliola sp. nov.

Arbor 18–20 m. alta, 20–30 cm. diametro; ramulis glabris, innovationibus puberulis; foliis abrupte pinnatis; petiolo ± 2 cm. longo, nudo; rhachi 1.5–9 cm. longa, dilatata, supra plana, linea mediana elevata notata, subtus subcarinata; foliolis 4–12, suboppositis vel alternis, oblongis (4–6 cm. longis, 1.5–2.5 cm. latis), basi obliquis, decurrenti-

acuminatis, apice breviter ac obtuse acuminatis, remotiuscule crenulatis, opacis, glabris, subcoriaceis, supra olivaceis vel viridescentibus, subtus pallidioribus; venis primariis utrinque circiter 9, haud prominulis, secundariis parallelis ac fere aequaliter manifestis; paniculis glabris, axillaribus, usque 15 cm. longis, ramulis paucis, brevibus; floribus pedicellatis (pedicellis ± 2 mm. longis); sepalis glabris, ciliatis, exterioribus ovatis, circiter 2 mm. longis, interioribus concavis, 3.5 mm. longis latisque; petalis 4, oblongis, 2 mm. longis, extus glabris, fere ad basim ciliatis, intus bisquamulatis, squamulis paullo inflexis, sursum dense villosis; staminibus 6–8, basi tantum hirtellis; disco unilaterali, hippocrepiformi, glabro; pistillo minuto, trilobato, glabro.

Netherlands New Guinea: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13082* (type), March 1939, alt. 850 m., primary rain-forest of flood plains (tree 18 m. high, 20 cm. diameter; flowers white); *Brass 13702,* alt. 900 m., March 1939, common in *Agathis* forest (subsidiary tree up to 20 m. high, 30 cm. diameter; leaves pale; flowers white).

Guioa crenifoliola with a hippocrepiform disk and fairly large flowers appears to belong to the section Hemigyrosa. It is readily distinguished by the crenulate or crenate leaflets.

Guioa Koelreuteria (Blanco) Merrill, Spec. Blancoanae 241. 1918; Enum. Philip. Fl. Pl. **2**: 507. 1923; Radlk. Pflanzenr. 98f (IV. **165**): 1165. 1933.

Guioa Perrottetii (Blume) Radlk. Sap. Holl.-Ind. 39. 1877, Pflanzenr. 98f (IV. **165**): 1172. 1933.

Solomon Islands: San Cristobal Island, Hinuahaoro, *Brass 2884,* September 1932, alt. 800 m., rain-forest (slender tree with white flowers and pink fruit). Previously reported from the Philippine Islands and Samoa.

Cupaniopsis Radlkofer

Cupaniopsis multijuga sp. nov.

Arbor gracilis, 3–5 m. alta; petiolo rhachique (folio unico tantum viso) 85 cm. longis, breviter tomentosis, subtus rotundatis, supra planiusculis, rhachi sursum convexa leviter sulcata; foliis usque 1 m. longis abrupte pinnatis, elongatis, multifoliolatis; foliolis circiter 60, usque 15 cm. longis, 2–2.5 cm. latis, chartaceis, fere subcoriaceis, subopositis, lineari-lanceolatis vel lineari-oblongis, basi inaequalibus ac late cuneatis ad obtusis, apice obtuse acuminatis mucronulatisque, a basi remotiuscule obtusissimeque serratis ad crenatis (dentibus 5–9 mm.

distantibus), inferioribus petiolulatis (petiolulis circiter 5 mm. longis, tomentosis), superioribus sessilibus, supra praeter costam pubescentem glabris, subtus puberulis vel laxe minuteque pilosulis; venis primariis utrinque 20–24 oblique patentibus, in dentes arcuatim terminantibus (sed non excurrentibus), supra leviter impressis, subtus prominulis; venulis reticulatis perspicuis; paniculis axillaribus, 15–20 cm. longis, axi ramulisque tomentulosis; floribus pedicellatis; sepalis extus sericeo-pubescentibus, intus interdum consperse pilosulis, margine minute glandulosis, exterioribus 2 mm. longis, ovatis, obtusis, interioribus suborbicularibus vel oblongo-obovatis, 2.5 mm. longis, concavis; petalis circiter 2.5 mm. longis, oblongo-ovatis, basi ac dorso secus lineam medianam pilosulis, intus ad basim pilosulis, squamulis 2 petalum dimidium vix aequantibus apice deflexis ac villosis; disco glabro; staminibus 6–8, filamentis 1 mm. longis, pubescentibus vel breviter villosis; antheris 1.5 mm. longis, oblongis, apiculatis, connectivo dorso ad lineam medianam consperse piloso; ovario (rudimentario) dense villoso, 3-loculari.

BRITISH NEW GUINEA: Central Division, Kubuna, *Brass 5660* (TYPE), November 1933, alt. 100 m., rain-forest substage, uncommon (unbranched slender tree 3–5 m.; stem hollow or pithy; dense terminal cluster of spreading leaves up to 1 m.; many short axillary panicles of small cream-colored flowers).

This species appears to be closely related to *Cupaniopsis multidens* Radlk. It has, however, much longer leaves with crenate leaflets, a glabrous disk, and stamens with densely pubescent or short-villous filaments.

Cupaniopsis remotidens sp. nov.

Arbor ± 3 m. alta, caule simplici; petiolo saltem 10 cm. et rhachi ± 45 cm. longis, puberulis ad dense pubescentibus, ± striatis; foliis abrupte pinnatis, multifoliolatis; foliolis ± 36, breviter petiolulatis (petiolulis 3 mm. longis, pubescentibus), gradatim ad apicem sessilibus, alternis, vel superioribus suboppositis, 9–18 cm. longis, 3–4 cm. latis, oblongis, basi valide inaequalibus, obtusis, apice acutis ad subacuminatis, margine remotiuscule dentato-serratis (dentibus circiter 1 cm. distantibus), supra praeter costam puberulam glabris, subtus praecipue costa puberulis ad glabris; venis primariis utrinque circiter 18, obliquis, supra manifestis, subtus prominulis, inter venis trabeculatim venulosis; paniculis axillaribus, breviter tomentulosis; floribus praeter partes sub fructu relictis haud visis; pedicellis 3–4 mm. longis; sepalis adpresse puberulis; petalis (fragmento tantum viso) extus glabris, intus squamulis villosius-

culis auctis; disco angusto, glabro; capsula 3-loculari, obtuse trigona, fere obovoidea, ± 1.5 cm. longa lataque, extus breviter tomentosa, in sicco reticulata, intus adpresse villosa; seminibus circiter 12 mm. longis, 9 mm. latis, 6 mm. crassis, compressiuscule ellipsoideis, arillo circiter usque ad medium obductis.

British New Guinea: Jawarere, *Brass 706* (type), November 1925, alt. 300 m., rain-forest (slender unbranched tree 3 m. high, with crown of long spreading pinnate leaves; inflorescence axillary; fruit orange tinted).

This species seems most like *Cupaniopsis curvidens* Radlk., but according to the description, the latter is a more pubescent plant; the leaflets are pilose on the lower surface and the inflorescence is sericeous-villous.

Cupaniopsis reticulata sp. nov.

Arbor gracilis, 4–5 m. alta, caule simplici; petiolo 18 cm. et rhachi 60 cm. longis, breviter fulvo-tomentosis, supra planiusculis, sursum 2-sulcatis; foliis abrupte pinnatis; foliolis circiter 24, subcoriaceis, 16–26 cm. longis, 5.5–7.5 cm. latis, superioribus alternis, sessilibus, oblongis, basi oblique obtusis ad paululo rotundatis, apice acutis vel breviter acuminatis, inferioribus suboppositis, breviter petiolulatis (petiolulis inferioribus 8 mm. longis sursum gradatim abbreviatis), fere ellipticis, basi valde inaequalibus, apice acutis vel breviter acuminatis, omnibus margine deorsum integris vel repandis, sursum irregulariter sinuatis vel ± obsolete crenulatis, supra olivaceo-viridescentibus, praeter costam venasque primarias tomentulosas glabris, subtus brunnescentibus, laxe pilosiusculis sed costa venisque primariis breviter tomentosis; venis primariis utrinque 14–20, supra perspicuis, subtus prominentibus, venulis reticulatis prominulis; paniculis axillaribus, ± 20 cm. longis, axi, ramulis, bracteis linearibus pedicellisque breviter fulvo-tomentosis; pedicellis circiter 2.5 mm. longis; alabastris ± 3 mm. longis latisque; sepalis 5, extus dense adpresse pubescentibus, exterioribus oblongo-obovatis, circiter 3 mm. longis, interioribus latioribus; petalis in flore ♀ 5, in flore ♂ interdum 6–8, quam sepalis brevioribus, ovatis, 2–3-nerviis, margine irregulariter sinuato-dentatis, dorso extus basi puberulis, brevissime unguiculatis, basi intus bisquamulatis, squamulis petalum dimidium fere aequantibus, apice incurvo ac marginibus ± dense villosiusculis; disco glabro; staminibus 8–9, filamentis brevibus, breviter villosis, antheris 2 mm. longis, oblongis, apiculatis, glabris; ovario ovoideo, dense hirsuto, plerumque 3-loculari; stylo 2 mm. longo, hirtello; fructibus non visis.

BRITISH NEW GUINEA: Central Division, Mount Tafa, *Brass 4134* (TYPE), alt. 2100 m., May–Sept. 1933, common in tall foothill forests (slender unbranched tree 4–5 m. tall, crowned with numerous stiff pale pinnate leaves, and bearing many axillary panicles of pale brown flowers).

In several respects this species suggests *Cupaniopsis curvidens* Radlk. and *C. insularis* Radlk.; nevertheless, it appears to be distinct in the different margin of the leaflets, the more pubescent and slightly larger flower-buds, and the glabrous disk. The inflorescence has both staminate and pistillate flowers.

Cupaniopsis phanerophlebia sp. nov.

Arbuscula 2 m. alta; caule simplici, apicem versus villoso-tomentoso ac sparse folioso; foliis abrupte pinnatis, saltem 60 cm. longis; petiolo 30–35 cm. longo, villoso-tomentoso (indumento detergibili) ad glabrato; rhachi ± 30 cm. longa; foliolis 8–12, chartaceis, alternis, 18–32 cm. longis, 5.5–7 cm. latis, inferioribus breviter petiolulatis (petiolulis circiter 4 mm. longis, tomentosis), superioribus sessilibus, omnibus oblongo-lanceolatis, apice acutis vel leviter acuminatis, mucronulatis, basi inaequalibus, obtusis, margine integris vel leviter repandis, supra viridescentibus, glabris, subtus brunneo-viridescentibus, interdum praeter costam venasque primarias laxe pilosas glabris; venis primariis utrinque 17–25 obliquis, ad marginem arcuatis ac interdum confluentibus, supra impressis, subtus valde perspicuis, venulis subtus prominulis; paniculis axillaribus vel supra-axillaribus, ± 20 cm. longis, axi bracteisque fulvo-villosis, ramis pedicellisque fulvo-tomentosis; sepalis 5, oblongo-obovatis, adpresse pubescentibus, circiter 2.5 mm. longis; petalis 2.5 mm. longis, unguiculatis, extus infra medium sericeo-pubescentibus, intus bisquamulatis, squamulis villosiusculis, cum petalorum margine connatis; staminibus 6–8 quam petalis paullo longioribus; filamentis 2.5 mm. longis, villosiusculis, antheris 1.2 mm. longis, glabris vel consperse pilosis; ovario subgloboso, 3-sulcato, dense hirsuto, 3-loculari, sessile; stylo 1.5 mm. longo, ± columnari, tomentoso; fructibus ignotis.

BRITISH NEW GUINEA: Palmer River, 2 miles below Black River Junction, *Brass 7039* (TYPE), June 1936, alt. 100 m., rain-forest undergrowth (rare small unbranched tree 2 m. high; leaves scattered toward the apex of the stem).

This seems to be a very distinct species readily recognized by the slender entire leaflets, the short inflorescence, the shaggy pubscence remaining around the base of the inflorescence and the petiole. The apex of the style is barely, if at all, cleft into three very short lobes; the flow-

ers are past anthesis, sufficient tomentum remaining on the style so we are uncertain as to the form of the stigma.

Cupaniopsis Kajewskii sp. nov.

Arbor usque 10 m. alta; innovationibus fulvo-tomentosis; petiolo saltem 7.5 cm. longo, pubescente; foliis abrupte pinnatis; foliolis 7–13, alternis, subcoriaceis, petiolulatis (petiolulis 4–10 mm. longis, puberulis), 9–30 cm. longis, 5–12 cm. latis, oblongis ad ellipticis, basi obtusis, apice acutis ad acuminatis (acumine ± 1 cm. longo), margine basim versus undulatis, apicem versus ± denticulatis, supra glabris, subtus glabris vel ± puberulis; venas primariis utrinque 9–16, supra impressis, subtus prominulis, inter venis ± manifeste trabeculatim venulosis; paniculis supra-axillaribus, in fructu ± 20 cm. longis, axi ramulisque breviter tomentulosis ad glabratis; pedicellis circiter 5 mm. longis; floribus praeter partes sub fructu relictas haud visis; sepalis adpresse pubescentibus, margine petaloideis; petalis quam sepalis brevioribus extus ± ⅔ dorso adpresse hirtellis, intus basim versus ± hirtellis, bisquamulatis; squamulis angustis, villosiusculis cum petalorum margine connatis; disco glabro vel parce pilosulo; filamentis 2.5 mm. longis, villosiusculis; capsula 2.5 cm. longa, 2.3 cm. diametro, ellipsoidea, 3-loculari, loculicide dehiscente, estipitata, extus breviter tomentosa, intus adpresse parceque pilosa; semine ellipsoideo, 15–19 mm. longo, 10 mm. lato, 8 mm. crasso; arillo tenui, fere semen obtegente, margine subfimbriato vel irregulari.

Solomon Islands: Bougainville, Kugimaru, Buin, *Kajewski 1781* (type), May 1930, alt. 150 m., rain-forest (common small tree up to 10 m. high; leaves compound with 7–13 leaflets; fruit yellow when ripe, breaking into 3 equal parts, 2.5 cm. long, 2.3 cm. diameter; seeds black, covered with an orange-colored aril).

The species is perhaps nearest *Cupaniopsis stenopetala* Radlk., but the latter has cuspidate-acuminate leaves and glabrous petals. There is much variation in the size of the leaves of *C. Kajewskii*, the measurements given above represent the smallest lower pinna and the largest intermediate one (those at the apex of the leaf are usually a little smaller).

Cupaniopsis caudata sp. nov.

Arbor 10 m. alta; innovationibus fusco-tomentosis; petiolo 20 cm. longo, fusco-pubescente; foliis abrupte pinnatis; foliolis chartaceis, petiolulatis (petiolulis circiter 1.5 cm. longis, minute fusco-pubescentibus), alternis, 14–32 cm. longis, 7–10.5 cm. latis, oblongo-ellipticis, basi obtusis, apice longissime acuminatis (acumine usque 5 cm. longo, basim

versus 5 mm. lato), margine integris, ± undulatis interdum repandis, supra praeter costam puberulam glabris, subtus puberulis, in axillis inter costam ac venas inconspicue foveolatis; venis primariis utrinque 10–18, oblique patentibus ad marginem arcuato-anastomosantibus, supra manifestis, subtus prominulis, inter venas trabeculatim venulosis; paniculis supra-axillaribus, 15–25 cm. longis, adpresse fulvo-tomentosis; pedicellis ± 4 mm. longis, dense pubescentibus; alabastris 4–5 mm. longis latisque; sepalis 5, concavis, extus dense pubescentibus, intus glabris vel ad basim consperse pilosiusculis, margine petaloideis, parce vel haud glandulosis, exterioribus ovatis, 4 mm. longis, interioribus paullo majoribus obovato-suborbicularibus; petalis ± 3 mm. longis latisque, unguiculatis (ungue 0.5–0.8 mm. longo), margine irregulariter dentato-lobatis pilosisque, extus adpresse pilosis, intus sparse pilosis bisquamulatisque, squamulis angustis, villosiusculis cum petalorum margine connatis (quapropter, sententia nostra, marginem inferiorem inflexum simulantibus); disco intus ac margine ± piloso, extus plerumque glabro; staminibus 10, filamentis 2 mm. longis, villosiusculis; antheris 2 mm. longis, oblongis, apiculatis; ovario subgloboso, dense tomentoso, 3-loculari; stylo 2 mm. longo, subtrigono, stigmatibus ex apice decurrentibus.

SOLOMON ISLANDS: Ysabel Island, Sigana, *Brass 3454* (TYPE), January 1933, alt. 100 m., hill rain-forests (slender tree 10 m. tall; branchlets, rhachis and petioles brown; flowers green outside, cream-colored inside; ovary brown).

This species closely resembles *Cupaniopsis Kajewskii* in the leaf-venation and the pubescence of the petals. The latter lacks the caudate-acuminate leaf-apices and the fairly long petiolules of this species.

Cupaniopsis platycarpa Radlk. Sitzungsber. Bayer. Akad. **20:** 359. 1890; Bot. Jahrb. **56:** 290. 1920; Rendle, Jour. Bot. **61:** Suppl. 11. 1923; Radlk. Pflanzenr. 98f (IV. **165**): 1196. 1933.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13698*, March 1939, alt. 850 m., on flood-plain rain-forest (tree 22 m. high, 30 cm. diameter; seeds yellow).

Only the original collection, *Forbes 790* (immature fruiting material), of *Cupaniopsis platycarpa* Radlk. has been recorded. *Brass 13698* shows mature fruit and stunted or galled flowers. The dried fruit is 7.5 cm. long, 6 cm. broad, 3 cm. thick, with the stipe scarcely 1 cm. long, and the abruptly acuminate apex about the same length; the seed (cotyledons in the seed examined unequal and incumbent) is approximately 2.5 cm. long and broad, covered by an aril; often only one ovule develops.

The flowers are fairly large: calyx coriaceous, the outer sepals 3.5 mm. long, the inner about 5 mm. long and wide, rounded, sericeous appressed-pubescent outside and at the base within, minutely glandular on the glabrous petaloid margin; corolla mostly broken or partly eaten by insects, the outer surface of the petal remnants ± sericeous-pubescent, the inner and upper part not so densely pubescent and sometimes glandular, the lower covered by an apparently single short-villous or densely hirtellous scale, the latter not at all uniform in size and shape in the several flowers dissected; stamens eight, filaments short-villous from base to apex, anthers oblong, sometimes tending to be obtusely sagittate at the base. There is such a mass of pubescence (probably abnormal) within the flower that it is difficult to determine the features of the disk. In the original description the disk is characterized as glabrous, and in the mature fruit a narrow, glabrous somewhat lobulate ring surrounds the base of the stipe.

Lepiderema Radlkofer

Lepiderema melanorrhachis sp. nov.

Arbor gracilis, alta; ramulis nigris, apicem versus sulcatis, puberulis vel glabris; foliis abrupte pinnatis; petiolo et rhachi 10–23 cm. longis, nigris, puberulis vel minute pubescentibus; foliolis 5–10, petiolulatis (petiolulis ± 5 mm. longis, pubescentibus), suboppositis vel interdum alternis, superioribus majoribus, oblongis, usque 14 cm. longis, 5–6 cm. latis, basi cuneatis, inferioribus minoribus, ± ovato-ellipticis, circiter 5 cm. longis, 2.5–3 cm. latis, basi late obtusis vel subrotundatis, omnibus apice breviter ac obtuse acuminatis (acumine 0.5–1 cm. longo), chartaceis, integerrimis, costa atque interdum venis primariis (obliquis, utrinque 7–10) pubescentibus; inflorescentiis axillaribus, subfasciculatis, in fructu 10 cm. longis; axi ac ramis minute pubescentibus; floribus praeter partes sub fructu relictas haud visis; sepalis 1.5 mm. longis, ovatis ad suborbicularibus; petalis circiter 2 mm. longis, ± anguste obovatis; disco glabro; staminum cicatricibus intra discum 8; capsula parva, cum stipite 2–3 mm. 1 cm. longa, circiter 1 cm. lata, turbinato-pyriformi, stylo brevi terminata, utrinque glabra vel extus parce ac minute lepidota.

British New Guinea: Oroville Camp, Fly River (30 miles above D'Albertis Junction), *Brass 7432* (type), August 1936 (tall slender tree of forest canopy; branchlets and petioles black).

This species is most like the description of *Lepiderema papuana* Radlk. from Misoel Island. The latter differs in having glabrous leaves with spreading rather than obliquely ascending primary veins. In *L. melanor-*

rhachis there is a downy pubescence on the rhachis, the midrib, and the axis of the inflorescence.

Jagera Blume

Jagera pseudorhus (A. Rich.) Radlk. forma **pilosiuscula** Radlk. Sitzungsber. Bayer. Akad. **9**: 621. 1879, Pflanzenr. 98f (IV. **165**): 1240. 1933.

BRITISH NEW GUINEA: Western Division, Oriomo River, Wuroi, *Brass 5803,* common in small forest clumps on savannah (tree of open habit; 6–7 m. tall; foliage pale; fruit orange-yellow, seeds black); Daru Island, *Brass 6437,* rain-forest fringing the mangroves (small tree 3–5 m. with pale pinnate leaves and numerous axillary panicles of small brown flowers); Lake Daviumbu, Middle Fly River, *Brass 7508, 7943,* common in drier parts of the rain-forest (petals pink); Penzara, between Morehead and Wassi Kussa Rivers, *Brass 8476.*

This is an Australian species; the first collection cited above was identified by Mr. C. T. White. The other collections are unquestionably conspecific. Although the field notes indicate a fairly common tree in this region, we have not yet found a previous record of its occurrence in New Guinea.

Arytera Blume

Arytera divaricata F. v. Mueller, Trans. Philos. Inst. Vict. **3**: 25. 1859; Radlk. Sap. Holl.-Ind. 44. 1877, Sitzungsber. Bayer. Akad. **9**: 510, 552. 1879, Pflanzenr. 98f (IV. **165**): 1278. 1933.

Nephelium divaricatum Bentham, Fl. Austral. **1**: 467. 1863.

BRITISH NEW GUINEA: Western Division, Lake Daviumbu, Middle Fly River, *Brass 7620, 7743,* August and September 1936, rain-forest substage (tree with thin brown bark shedding in small hard scales; flowers white; lateral leaflets erect on the rhachis); Wassi Kussa River, Tarara, *Brass 8422,* December 1936, rain-forest (lesser canopy tree 12 m. high; fruit yellow, compressed).

The specimens cited above are altogether too close to the description of *Arytera divaricata* F. v. Muell. from Queensland to be regarded as a distinct species without further material for comparison. The leaflets are a little larger than the limit of size given by Radlkofer, Pflanzenr. l.c., but scarcely more than Bentham allows for *Nephelium Beckleri* Benth. which Radlkofer accepts as conspecific.

Another collection entirely similar in foliar characters but with shorter and more turgid capsular lobes is *Brass 8483,* Tarara, December 1936,

rain-forest substage (tree 8 m. high; fruit compressed, orange-yellow, aril red, seeds purple).

Arytera foveolata F. v. Mueller, Trans. Philos. Inst. Vict. **3:** 24. 1859; Radlk. Sap. Holl.-Ind. 44. 1877, Sitzungsber. Bayer. Akad. **9:** 510. 1879, Pflanzenr. 98f (IV. **165**): 1279. 1933.

British New Guinea: Central Division, Kubuna, *Brass 5560,* alt. 100 m., ridge-forest (common substage small tree; leaves greyish underneath; numerous small white flowers).

The collection was determined as representing this species or affinity by Mr. C. T. White and we see no reason for changing it. The species was previously known only from Australia.

Mischocarpus Blume

Mischocarpus lachnocarpus (F. v. Muell.) Radlk. Sap. Holl.-Ind. 43. 1877, Sitzungsber. Bayer. Akad. **9:** 536, 647. 1879, Pflanzenr. 98f (IV. **165**): 1304. 1933.

British New Guinea: Central Division, Ononge Road, Dieni, *Brass 3994* (det. C. T. White), May 1933, alt. 500 m., rain-forest (slender little tree with shining leaves and numerous small greenish white flowers); Western Division, Wassi Kussa River, Tarara, *Brass 8734,* rain-forest underbrush (slender tree 6–8 m. high; flowers green).

Previously known only from Australia. *Brass 8734* is not so tomentose as *Brass 3994,* otherwise the two are very similar.

Mischocarpus pyriformis (F. v. Muell.) Radlk. Sap. Holl.-Ind. 43. 1877, Sitzungsber. Bayer Akad. **9:** 536, 647. 1879, Pflanzenr. 98f (IV. **165**): 1305. 1933.

British New Guinea: Western Division, Wassi Kussa River, Tarara, *Brass 8508,* December 1936, common in rain-forest substage (tree; leaf-margins recurved; flowers cream-colored).

Although the leaves of *Brass 8508* are lanceolate rather than ovate-lanceolate and a little longer than those of most of the Australian material of *Mischocarpus pyriformis* (F. v. Muell.) Radlk., the collection seems to agree in all other characters with this Australian species.

Mischocarpus montanus C. T. White, Proc. Roy. Soc. Queensl. **47:** 56. 1936.

Northeastern New Guinea: Morobe District, Sarawaket, *Clemens 5232,* January 31, 1937.

Mischocarpus montanus C. T. White was based on a collection in flower (*Brass 2293*), from North Queensland. *Clemens 5232* is a fruiting specimen; nevertheless, it appears to be a reasonably good match for

the type-material of this species. The clavate-pyriform fruit is 1.5 cm. long (not yet fully mature) and 0.5 cm. diameter.

Mischocarpus macrobotrys sp. nov.

Arbor ± 20 m. alta; ramulis glabris; innovationibus fulvo-puberulis; foliis usque ± 70 cm. longis, abrupte pinnatis; petiolo atque rhachi glabris, striatis; foliolis 11–12, alternis, glabris, opacis, subcoriaceis, petiolulatis (petiolulis 0.8–1.4 cm. longis, basi tumidis ac rugosis), oblongis (8–21 cm. longis, 3.3–7 cm. latis, in specimine typico 10–13 cm. longis, circiter 4 cm. latis), utrinque angustatis, apice obtuse ac breviter subacuminatis, margine undulatis, venis primariis utrinque ± 14, patenti-adscendentibus marginem versus arcuatis, venularum reti inaequali laxa, subtus in axillis inter venas atque costam domatia pluria gerentibus; paniculis ad ramorum apices congestis, ± dense puberulis vel minute pubescentibus, amplis, ± 45 cm. longis, multifloris; sepalis 0.8 mm. longis, deltoideis, acutis, minute puberulis; petalis 1 mm. paululum superantibus, vix unguiculatis, intus puberulis atque supra unguem bisquamulatis, squamulis hirtellis; disco glabro, sublobato vel undulato; staminibus brevibus; filamentis 1 mm. longis, hirtellis; antheris glabris; pistillo 2.5 mm. longo, adpresse puberulo; ovario obovato, circiter 1 mm. longo, estipitato, triloculari; stylo ± 1 mm. longo, stigmate recurvato-trilobo.

BRITISH NEW GUINEA: Lake Daviumbu, Middle Fly River, *Brass 7618* (TYPE), August 1936, rain-forest substage (tree; leaves smooth and shining, to ± 70 cm. long; flowers cream-colored).

In several characters this species suggests *Mischocarpus paradoxus* Radlk. In the latter, there are only seven leaflets to a leaf, the inflorescence is up to 14 cm. long, and clustered on the more mature branches, the last character is emphasized both in the key to the genus and in the description of the species. In *M. macrobotrys,* on the other hand, the inflorescence is much more ample, and the panicles are clustered around the tips of the young growth.

Mischocodon Radlkofer

Mischocodon reticulatus Radlk. Bot. Jahrb. **50**: 79. 1913, Pflanzenr. 98f (IV. **165**): 1328. 1933.

NORTHEASTERN NEW GUINEA: Sattelberg, *Clemens 1933A, 3093,* March and May 1936, alt. ± 100 m.

Only the original staminate collection has been recorded. In the flowers of *Clemens 1933A,* the stamens are about 2 mm. long, the pistil is stipitate, the stipe being 2 mm. long, the ovary (3–4-loculed, with one

ascending ovule in each locule) about as long and 3–4-angled, and the style 1.5 mm. long, with 3–4 scarcely longer stigmatic lobes.

Dodonaea Linnaeus

Dodonaea polyandra sp. nov.

Arbor gracilis, 5–7 m. alta, glabra; ramulis compressis, vix angulatis; cortice viscoso; foliis simplicibus, petiolulatis (petiolulis 0.6–1.5 cm. longis, viscosis), anguste lanceolatis ad late lanceolatis (6.5–12 cm. longis, 1.8–4 cm. latis), utrinque angustatis, basi sensim attenuatis, apice plerumque breviter ac obtuse acuminatis, margine integris vel subundulatis, paullo revolutis, chartaceis, supra olivaceis vel olivaceo-viridescentibus, viscosis, subnitidis, subtus interdum paullo pallidioribus, crebre glandulosis; costa subtus ad basim foliorum prominente; venis primariis utrinque 8–10 oblique patentibus, ad marginem arcuatim confluentibus, haud prominulis; inflorescentiis terminalibus in ramis ramulisque, brevibus, usque 4 cm. longis, subcorymbiformibus, viscosis; floribus (♀) longe pedicellatis (pedicellis circiter 1 cm. longis); sepalis 4–5, linearioblongis, ± 3 mm. longis, +1 mm. latis, apice villosis; ovario trigono, 1.5 mm. longo, 1 mm. lato, dense viscoso; stylo ± 5 mm. longo, apice 2–3-fido vel indiviso; capsula suborbiculari, alis loculorum latitudinem subaequantibus, 2.5 cm. lata 2–2.5 cm. longa (alis inclusis), in sicco subfusca, 2–3-loculari; seminibus 2.5 mm. longis, 2 mm. latis, fere 2 mm. crassis, nigris, nitidis, plerumque membrana albicante tenuissima pellucida praesertim ad hilum corrugata indutis; floribus (♂): sepalis ut in flore ♀ sed brevioribus; staminibus 11–15, filamentis 0.5–1 mm. longis, antheris circiter 2.5 mm. longis, apiculatis; pistillo rudimentario.

British New Guinea: Western Division, Wassi Kussa River, Tarara, *Brass 8379* (type), *8379A*, December 1936, abundant in rain-forest fringing streams (very slender tree 5–7 m. high, dioecious).

This species closely resembles some forms of *Dodonaea viscosa* (L.) Jacq. It differs in having 12–15 stamens (the species of the genus have ordinarily 5–8 stamens), and shining seeds, scarcely at all compressed, and covered by a thin transparent membrane much wrinkled toward the callus surrounding the hilum.

Harpullia Roxburgh

Harpullia cauliflora K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee 424. 1900; Radlk. Pflanzenr. 98f (IV. **165**): 1440. 1933.

Netherlands New Guinea: Bernhard Camp, Idenburg River, *Brass 13802*, April 1939, alt. 60 m., rain-forest of alluvial plains (subsidiary tree 20 m. high, with few upright myrmecophilous branches; fruit red, borne on the old wood).

Having no authentic material for comparison, we hesitantly assign this collection to *Harpullia cauliflora* Radlk. It differs in the following points: leaflets chiefly alternate, subequilateral to inequilateral at base; capsules short stipitate; sepals carinate; and the branches obviously myrmecophilous.

Harpullia myrmecophila sp. nov.

Arbor parva, 2–4 m. alta; ramulis ac petiolis puberulis, intus fistulosis; foliis abrupte pinnatis, irregulariter circiter 4-jugis; petiolo 9–11 cm. et rhachi ± 28 cm. longis; foliolis 7–8, petiolulatis (petiolulis 5–10 mm. longis), alternis, coriaceis, utrinque glabris vel costa venisque puberulis, nitidulis, inferioribus brevibus (7.5–15 cm. longis, 5–8 cm. latis), superioribus longioribus (± 24 cm. longis, 9 cm. latis), omnibus ellipticis, basi subaequalibus, apice ± abrupte acuminatis (acumine 0.5–1.2 cm. longo), integerrimis, venis primariis utrinque ± 10, arcuato-adscendentibus, supra perspicuis, subtus prominentibus, prominule reticulato-venulosis; inflorescentiis supra-axillaribus, in fructu usque 15 cm. longis, breviter fulvo-tomentulosis; pedicellis 5 (fructigeris ad 9) mm. longis; alabastris subsphaeroideis; sepalis 5, basi paullo connatis, ovato-ellipticis, 5 mm. longis, 3 mm. latis, obtusis, utrinque brevissime tomentulosis; petalis 5, carnosis, glabris, ex oblongis subcuneatis, 10 mm. longis, 3 mm. latis; staminibus 5, antheris lineari-lanceolatis, basi excisis; disco pumilo, tomentuloso; ovario 1 mm. longo, compresse ellipsoideo, tomentuloso; stylo brevi (0.5 mm. longo); capsula suborbiculari ad paululo obovata, 2.4–3 cm. longa, 2.2–2.5 cm. lata, vix stipitata, breviter apiculata, glabrata, intus glaberrima; semine in loculo solitario, arillo usque ad apicem obtecto.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13414* (TYPE), March 1939, alt. 850 m., on the bank of a stream in the rain-forest (sparse tree 4 m. high; branches myrmecophilous; fruit red; seeds yellow); *Brass 13285*, alt. 850 m., March 1935, rain-forest seral growths (slender tree 2 m. high; flowers greenish white).

Harpullia myrmecophila belongs to the subgenus EUHARPULLIA Radlk., section THANATOPHORUS Radlk. The somewhat crooked branchlets are hollow, and along the petiole and rhachis are numerous very small openings. The leaves are very much like those of the collection assigned to *H. cauliflora* K. Schum. & Lauterb., but the capsules are dissimilar both in form and in size.

Harpullia vaga sp. nov.

Arbor parva, 7–8 m. alta; ramulis glabris; foliis abrupte pinnatis;

petiolo ± 8 cm. et rhachi 15–20 cm. longis, glabris, teretibus; foliolis 4–9, glabris, chartaceis ad subcoriaceis, breviter petiolulatis (petiolulis 5–7 mm. longis), alternis vel suboppositis, 9.5–15 cm. longis, 4–5 cm. latis, lanceolato-oblongis, apice acutis ad subacuminatis, basi subaequalibus, cuneatis ad obtusis, integerrimis; venis primariis utrinque 9–10, arcuato-adscendentibus, supra manifestis, subtus prominentibus, ± manifeste reticulato-venulosis; inflorescentiis verisimiliter axillaribus, axi fructigero 36 cm. longo; ramulis pedicellis calyceque fulvo-tomentulosis; sepalis ovatis, 4 mm. longis, obtusis; staminum cicatricibus 5; disco tomentuloso; capsula suborbiculari, 2.3 cm. longa, 2.5 cm. lata, breviter stipitata (stipite circiter 3 mm. longo), apice emarginata, extus glabrescente, intus glabra, crustacea; semine in loculo solitario, ex toto arillo involuto.

Solomon Islands: Guadalcanal, Uulolo, Tutuve Mountain, *Kajewski 2544* (type), April 1931, alt. 1200 m., rain-forest (common small tree up to 7 or 8 m. high; fruit bivalvular, 2.5 cm. long, 2.5 cm. diameter).

The species belongs to the subgenus Euharpullia Radlk., Section Thanatophorus Radlk. It differs from *Harpullia cupanioides* Roxb. in the somewhat longer capsule, and the dull leaves.

CORNACEAE (det. Danser)

Mastixia Blume

Mastixia philippinensis Wangerin, Rep. Sp. Nov. **10:** 273. 1912; Merr. Enum. Philip. Fl. Pl. **3:** 241. 1923.

Solomon Islands: Bougainville, Koniguru, Buin, *Kajewski 2021, 2086,* August and October 1930, alt. 850 m. and 950 m.; Guadalcanal, Uulolo, Tutuve Mountain, *Kajewski 2547,* April 1931, alt. 1200 m.

The field notes are here summarized: tree up to 30 m. high, with a fairly long trunk; petals green; stamens cream-colored, falling off after the buds open; fruit blue when ripe, oblong, 2.5 cm. long, 1.5 cm. diameter. The natives say this is a very strong timber used in building their large Garamut or ceremonial houses. Previously known from the Philippine Islands.

Since this is the only species in our material with a range-extension we have credited the work on the family to Dr. B. H. Danser who, some time ago, determined *Kajewski 2021.* The other collections cited appear to be conspecific.

Arnold Arboretum,
Harvard University.

THE ARNOLD ARBORETUM DURING THE FISCAL YEAR ENDED JUNE 30, 1940

As in previous years the Arboretum has been the fortunate recipient of generous extra-budgetary support which enables the staff to accomplish much needed work that cannot be taken care of properly on the basis of the regular institutional income. Unrestricted gifts to the Cultural Purposes Fund amounted to $7757.00 from 382 individuals, an increase of $657.00 over similar receipts in the preceding year. Belated returns from the Hurricane Rehabilitation appeal of October, 1938, increased that restricted fund by $60.00. The Massachusetts Society for Promoting Agriculture generously renewed its grant of $500.00 to finance botanical-horticultural explorations in China, and this special fund was increased by a gift of $450.00 from Mr. Harrison W. Smith of Tahiti. Special contributions amounting to $3525.00 were made to support the George B. Emerson Fellowships I, II, and III, $1000.00 of this being from an anonymous donor. These Fellowships were so named in honor of the individual who originated the Arboretum idea. For special travelling expenses $790.00 was received, $590.00 of this amount being an anonymous gift, and $200.00 from Mrs. Edwin F. Atkins for special work at the Atkins Institution. A member of our Visiting Committee generously continued his annual gift of $500.00 for the care of conifers. A special grant of $1500.00 has been received from the Milton Fund of Harvard University to be used under my direction for completing work on our extensive collections of plant material from southern China. At the Atkins Institution, $600.00 was received as grants-in-aid for visiting students. During the year the permanent endowment funds were increased by the receipt of $12,500.00 from the estate of the late Miss Grace L. Edwards of Boston, and $1205.18 was added from income to two special endowment funds in accordance with the original terms of gift.

Retirements and Appointments. — At the end of December, 1939, Miss Ethelyn M. Tucker retired after forty years of service to the Arboretum, first as an assistant, later in charge of the library. Throughout her long term of employment Miss Tucker rendered valuable and efficient services to the institution and thoroughly established her standing in the field of botanical bibliography through the preparation and

publication of the comprehensive three volume "Catalogue of the Library of the Arnold Arboretum." At the end of August, 1940, Professor Alfred Rehder will retire, having passed the age of seventy-five years, this being the ultimate age at which employment may be continued. He has served the institution with outstanding distinction for forty-two years. At the same time Dr. J. H. Faull retires as Professor of Forest Pathology, after twelve years efficient service in that position. Fortunately for the best interests of the Arnold Arboretum both Professor Rehder and Professor Faull plan to continue work on special problems in which they are personally interested. Mrs. Janet Sellars was promoted to the position of Librarian, and Mr. V. Asmous was appointed Assistant Librarian. To succeed Professor Rehder as Curator of the Herbarium, Dr. A. C. Smith, of the New York Botanical Garden, has accepted appointment as of October 1, 1940. No appointment can yet be made in forest pathology because of the necessity of taking care of the genetics situation, which was left in a greatly depleted condition following the death of Dr. E. M. East in 1938.

Buildings and Grounds. — The regular procedure has been followed as in past years with the objective of maintaining all buildings in good condition and in not only maintaining but also increasing the attractiveness of the grounds and plantings. A major operation, the widening of Bussey Street, is being accomplished by the City of Boston, involving the construction of a new masonry boundary wall along the south side adjoining the Peters Hill section. This, when completed, will be a great improvement. Various repairs to the road surfaces, benches, walls and entrance gates have been accomplished by the Park Department. During the past winter most of the work of removing stumps and fallen trees, mute reminders of the damage caused by the great hurricane of September, 1938, was practically completed. Through the acquirement of some additional mechanical equipment the efficiency of the outside staff has been increased. We are now, for the first time, in a position where the cutting and removing of hay is handled by our own staff without the necessity of our contracting for this necessary annual task with outside parties. Approximately 350 conifers, three to four feet high, were planted in the fall in connection with our hurricane damage rehabilitation work, the mortality being gratifyingly small in spite of an unusually dry autumn and a severe winter. Approximately 200 additional hemlocks, now being grown in our nurseries, will be planted on Hemlock Hill in the fall of 1940. During the year all survey work appertaining to the detailed mapping of the Arboretum plantings was completed. Final

drawings were made of 30 panels, and these were checked for accuracy, making a total of 82 panels completed. The remaining 16 will be finished during the coming winter. For a third consecutive year, the poison ivy eradication campaign was viorously prosecuted, the net results being a great reduction of this noxious plant in many parts of the grounds.

Horticulture. — The *Forsythia* planting at the end of the lilac collection, cut to the ground two years ago is now in excellent condition, and henceforth should make a most attractive annual display. Another bank of *Forsythia intermedia spectabilis* has been planted on the slope back of the Administration Building facing the Arborway, 75 individual plants having been used. As many unneeded duplicate *Weigelia* plants were removed from this rather neglected collection last fall, it became necessary to cut most of the remaining plants to the ground to stimulate new growth. Through the courtesy of Mr. F. W. Schumacher, a fine collection of colored water lilies was received and planted in the ponds near the shrub collection. During the winter all of the remaining old and decrepit willows were removed along the Arborway wall, red maples and sour-gum being planted in their place. The rose collection was carefully checked, many duplicates discarded, and through the courtesy of Messrs. Bobbink and Atkins, forty species and varieties were added, the collection now containing about one hundred species and varieties, this being a botanical collection rather than a horticultural one. A collection of *Hemerocallis* was presented by the New York Botanical Garden and an assortment of tree peonies by Mr. John C. Wister of Philadelphia. The largest single accession was a shipment of 115 plants acquired from Hillier's Nursery in England and delivered some months after the war commenced; a number of species in this lot are new to American collections. A total of 283 species and varieties were transferred from the nurseries to their permanent places in the grounds, most of which represent species new to the collections.

In the collection of hybrid azaleas on Bussey Hill are many excellent varieties, but the plantings are now badly crowded. In the fall, fifty of these were transferred to the slope opposite the hornbeam collection, and more will be transplanted later in order to make a colorful display among the oaks.

An unusual amount of pruning had to be done in the spring and summer, partly on account of hurricane damage that could not be handled previously, partly because the past winter was an unusually difficult one, much winter injury occurring, particularly in March.

From the Arboretum plantings 552 packets of seeds, and from the cooperative Arnold Arboretum - Fan Memorial Institution Yunnan expedition collections, 824 packets, a total of 1376 packets were distributed to institutions and individuals in the United States and nine foreign countries. At the same time 4115 living plants and 946 lots of cuttings and scions went to various institutions and individuals in the United States and four foreign countries. Among the plants distributed were 3000 hybrid ornamental crabapple seedlings to 337 institutions and individuals. These were grown in connection with Dr. Sax's hybridization work and were distributed with the understanding that the Arboretum has the right to take propagating material from any plant that may prove to be of exceptional horticultural value. In eliminating unwanted duplicate material from the general plantings, several truck loads of plants were presented to Boston University, Tufts College, the University of New Hampshire, and the Boston Park Department. Many other public institutions received living plants in the ordinary course of plant distribution.

Accessions to the Arboretum include 2114 living plants, 140 packets of seeds (including only those actually planted in the propagating houses), 721 packets of Yunnan seeds from the Fan Memorial Institute of Biology, these mostly redistributed because the species represented are not adapted to New England climatic conditions, and 19 lots of cuttings and scions.

Having encountered various difficulties in the past in our attempts to disseminate recently introduced plants or those of outstanding horticultural value through the medium of scions and cuttings, we have now adopted a policy of actually growing rare items for distribution as established plants. The recipients are thus placed in a position so that they can do their own propagating from established stock. It is believed that this policy will expedite the establishment in other centers of important horticultural forms introduced by the Arboretum.

In connection with the horticultural activities of the institution, many popular lectures have been given, the rapidly increasing correspondence regarding plants and plant problems has been taken care of, and the Bulletin distribution has been increased, the mailing list now exceeding 2000 names. An interesting development has been the rapidly increasing use that is being made of our source list of desirable horticultural plants.

Cytogenetic Laboratory. — The work in experimental cytology under Dr. Sax has included an extensive analysis of differential sensitivity of cells to X-rays. X-ray sensitivity during the nuclear cycle in

the *Tradescantia* microspore, as measured by chromosome aberrations, is at a minimum early in the resting stage and the period of greatest sensitivity is slightly before mid-prophase. Of the various cells the sporocyte is most sensitive with decreasing sensitivity found in microspores, root-tip cells and generative nuclei in *Tradescantia*. *Tradescantia* microspores are twice as sensitive to X-rays as are those of *Allium*. Differential sensitivity appears to be determined by factors involving the capacity for chromosome movement. The production of chromosome aberrations is only one of several effects of X-radiation which may cause the death of the cell.

The behavior of aberrant chromosomes in successive cell generations has been studied in onion root-tips. Apparently, the cells with aberrant chromosomes cannot compete effectively with normal cells and in later cell generations few aberrations are found. This conclusion is also supported by the behavior of X-rayed seedlings of numerous ornamental trees and shrubs. Doses of X-rays ($\pm$ 40,000r), sufficient to inhibit growth for several weeks or longer, produced no apparent effect on the plants at a later period in their development. Abnormal plants resulting from gross chromosome aberrations can best be produced by X-raying pollen to produce zygotes with unbalanced genoms, which are not subject to competition with normal cells. This method has been used successfully with *Petunia* by Dr. Rick.

The exponential increase of chromosome aberrations with X-ray dosage has been difficult to reconcile with the linear relation between dosage and mutation frequency since it is known that many mutations are caused by chromosome rearrangements. The discrepancy is still greater since Dr. Rick found that the small interstitial deletions also show an exponential increase with increased dosage.

On the other hand, Dr. Rick has found that chlorophyll deficiencies in barley are produced in greater frequency when the seeds are X-rayed at low temperatures. Radiation of cells at low temperatures is more effective than radiation at high temperature, as measured by chromosome aberrations.

The radiation work has been extended considerably by Mr. Swanson and Dr. Giles. Mr. Swanson has found that ultra-violet radiation produces breaks in only one of the two sister chromatids at prophase. X-rays may break one or both chromatids at a given locus, but a single "hit" cannot break chromatids of different chromosomes. Dr. Giles has found that a single "hit" resulting from neutron radiation can break one or both sister chromatids or chromatids of different chromosomes. This

greater effectiveness of neutrons is attributed to greater ionization density in the proton path than in the electron path produced by X-rays.

The mechanics of mitosis has been studied in divisions of generative nuclei in pollen tubes of several genera. Where spatial relations permit, the chromosomes form an equatorial plate and divide regularly, but large chromosomes in a narrow pollen tube may divide without congregating on an equatorial plate and are distributed irregularly to the poles.

Chromosome behavior in an induced autopolyploid of *Tradescantia* resembles that to be expected in an allopolyploid. Mr. Skirm attributes this behavior to structural hybridity. This conclusion is supported by the work of Mr. Swanson who finds that both pure species of *Tradescantia,* as well as the hybrids, are heterozygous for numerous inversions.

A considerable number of ornamental shrubs have been treated with colchicine to produce polyploidy. A few polyploid plants have been obtained. Other techniques for inducing polyploidy are being tried.

The breeding work has been carried on extensively. Several thousand natural hybrid crabapple seedlings were grown in 1939. Several hundred were saved for testing and the others were distributed to persons interested in such work. In the spring of 1940 several thousand apple and an equal number of cherry seedlings were set out in the nursery to be selected or distributed next spring. Seeds from hybrids in the Arboretum have also been grown to get recombinations of favorable characters. The controlled pollinations in species hybridization has been continued with apples, cherries, lilacs, azaleas, and magnolias. Numerous hybrids are in the cold frames or nurseries. This work has been facilitated by the assistance of the graduate students, their wives, and of a volunteer worker, Mr. John Minns.

Wood Anatomy. — Extensive investigations of a wide range of representative dicotyledons have demonstrated that there are clearly defined trends of structural specialization in the cambium and xylem of the higher plants. Certain of these trends of evolutionary modification are irreversible and are significant not only in the identification of living and fossil woods but also in the investigation of the phylogeny and relationships of the various families and orders of the dicotyledons. Their significance in the study of lesser taxonomic units, viz., species, genera, tribes and sub-families, can be determined only by intensive investigations of specific families. During the last two years, we have initiated such an investigation of the pan-tropical family, *Icacinaceae,* and have assembled material for detailed comparative studies of the stem, node, leaf, floral organs and pollen. It has been essential in this connection to

devote considerable attention to the task of developing improved techniques for the microscopic analysis of herbarium material.

Various individuals are collaborating with Dr. I. W. Bailey in different phases of these investigations. Dr. Dahl is providing expert knowledge in the study of pollen. Mr. Howard is undertaking a critical taxonomic revision of the Icacinaceae under the direction of Professor Johnston. Mr. Hyland has developed a much improved paraffin technique for the rapid sectioning of stems from herbarium specimens. Mr. Barghoorn's studies of ray ontogeny, although not confined specifically to the Icacinaceae, are providing a more reliable basis for interpreting the ray structures in this family. Dr. Watson, Commonwealth Fellow in Botany, has devoted his attention to the Euphorbiaceae, certain genera of which must be considered in any general discussion of the Icacinaceae. Working in association with Professor Bailey and Professor Wetmore, Mr. Heimsch has continued his survey of the wood structure of the Geraniales and Sapindales in an endeavor to correlate histological data with current taxonomic concepts. Dr. Charlotte Nast has initiated a study of parenchyma patterns with view to understanding their ontogenetic and phylogenetic implications. Dr. Carlos O'Donnel, visiting professor from Tucuman University, has given special attention to the significance of wood structure in the Convolvulaceae as well as the Santalaceae, Olacaceae, Styraceae and presumed related families.

During the year 3,374 microscopic slides have been added to the collection of wood sections, the total now being 23,593. An attempt has been made to secure a representation of various small families in this basic collection, eighteen families having been added. This material was received from various herbaria, and through the cooperation of Dean S. J. Record and Professor R. W. Hess of the Yale School of Forestry. Special attention has been given to sectioning representatives of the Anacardiaceae, Meliaceae, Burseraceae, Rutaceae, Sapindaceae, Euphorbiaceae, Icacinaceae, Styraceae, Santalaceae, Polygalaceae and Alangiaceae.

Plant Pathology. — There has been an undiminished number of inquiries seeking advice on tree and shrub diseases. During the course of a year these naturally cover a wide range of subjects. But proper attention to them is important, for it fulfills one of the functions of the Arboretum and in addition sometimes helps to indicate needed research.

Much time has been expended on bringing into more readily workable order an accumulated collection of Polypores. An herbarium especially rich in species found in northeastern America results; but there is also

a considerable representation from other parts of America and some from other parts of the world. This collection will be deposited in the Farlow Herbarium.

Research has been actively carried on by Dr. Faull and four graduate students under his sponsorship, namely, Messrs. E. V. Seeler, A. E. Prince, C. J. Gilgut, and R. Gosselin.

Dr. Seeler has completed an investigation of two hitherto unknown diseases of *Gleditsia*. Both prove to be caused by a fungus native to America, *Thyronectria austro-americana* (Speg.) Seeler. This subject was undertaken primarily to determine the cause of a wilt that suddenly destroyed some *Gleditsia japonica* trees in the Arboretum that had been doing well from the time the species had been introduced in 1904. The project was enlarged when it was discovered that the same fungus causes a canker of the American *G. triacanthos*. The latter is rather slow-acting, but can be fatal. Fortunately, from its nature, it should be readily controllable. Control of the wilt disease in *G. japonica,* however, is another matter. Evidently choice of this species for planting in America calls for discretion, and should the causal fungus find its way into the home regions of *G. japonica,* severe losses would probably result. As part of his final program Dr. Seeler revised the genus *Thyronectria* and has prepared two papers which have been published in this Journal.

Mr. Prince, who had studied the species of *Gymnosporangium* occurring in Maine, elected to investigate *G. nidus-avis,* a broom-forming rust on *Juniperus* and a parasite on certain of the Pomaceae. The wealth of experimental plants available at the Arboretum has enabled him to complete important biological studies on that subject. His results, when published, will form a continuation of the earlier studies made by Drs. Crowell and MacLachlan at the Arboretum on certain other economically significant species of *Gymnosporangium*. As a result of the work of these men, we now have a much extended knowledge of the hosts subject to attack from species of *Gymnosporangium* and of their relative susceptibilities. This is of practical aid in choosing and arranging planting stock. It may also be added that Crowell and MacLachlan worked out a method of control of *Gymnosporangium* rusts that obviates control by eradication of the alternate host.

Mr. Gilgut is continuing his investigation of a serious basal trunk canker of the flowering dogwood and has confirmed Creager's findings that it is caused by a species of *Phytophthora*. Our first attention to it was in connection with our work in a field laboratory on the estate of Mrs. Harold I. Pratt on Long Island. We now know that it occurs in other localities one of which is in western Massachusetts. In addition

to etiological studies, efforts are being made to devise satisfactory control measures.

Mr. Gosselin is concentrating on the study of a butt heart rot of conifers caused by a widely spread virulent polypore. This topic seems to have a bearing on forestry practice and on estimates of the future history of some stands of timber.

Dr. Faull's own work is still largely concerned with biological and taxonomic studies of certain rust genera. *Hyalopsora* rusts are the immediate subjects under investigation. Pertinent to this research, various parts of Mexico were visited last November and December ranging from the State of Chihuahua in the north to Chiapas in the south. Of special interest was the discovery in Chiapas of forests in which there is an intermixture of firs and tropical ferns. As firs and ferns are the alternate hosts of various rust fungi and as these rusts may be perpetuated in mild climates on the fern hosts alone, an explanation is suggested for the unexpectedly rich development of these rusts on tropical ferns far beyond the range of *Abies*. A second subject now engaging his attention is a widely spread wilt disease of certain hardwoods. Heretofore, this topic has received meager study because of failures to transmit the disease artificially. This difficulty has been overcome and the disease can now be studied from its inception.

The Herbarium. — The number of mounted specimens actually inserted into the Herbarium was rather small, only 9525 sheets, but supplementing this number approximately 40,000 specimens were mounted, but being identified only in part are hence not yet ready for distribution into the herbarium. The total number of specimens now filed in the herbarium amounts to 494,467 sheets.

The number of specimens (including duplicates) received during the year amounts to 67,212 of which 42,497 are from America, 13,701 from China, 793 from Eastern Asia exclusive of China, 4032 from Indo-China, 4936 from Malaysia, Papuasia and Polynesia, and 1253 from Europe, Central Asia and Africa. Among the more important Asiatic collections received is one of 7911 specimens from Yunnan by T. T. Yü, two sendings of about 4400 specimens (including duplicates) from southeastern China by W. T. Tsang, one of 997 specimens from Indo-China by Dr. A. Pételot, and one of about 3000 specimens (including duplicates) by W. T. Tsang also from Indo-China. Important American collections received were about 5000 specimens from British Guiana made by A. C. Smith on the Terry-Holden Expedition, 2875 specimens of Bolivian plants of the Steinbach Herbarium, 3452 specimens from

Argentina and Chile, received by Dr. Johnston for identification and 1540 specimens collected in Mexico by him, 3331 specimens collected by Woodson, mostly from Panama, 1312 specimens from Mexico and Central America received from the University of Michigan, 1171 specimens collected by J. W. Thompson in British Columbia, and 14,300 specimens collected by H. M. Raup in the MacKenzie Mountains in northwestern Canada.

In continuation of exchanges 2996 duplicate specimens were distributed, mostly to American institutions and 1298 duplicates were sent to various specialists for identification. To the Gray Herbarium were transferred 14,440 specimens, 1743 illustrations and their accompanying descriptions, while 569 specimens and 240 illustrations and descriptions of orchids were sent to the Ames Orchid Herbarium at the Botanical Museum, and 162 specimens of cellular cryptogams to the Farlow Herbarium. The total distribution of specimens amounted to 19,465, and of illustrations 1983.

Twenty-six loans approximating 2300 specimens were sent to 13 institutions, mostly American. For study by members of the staff, 36 loans involving over 2100 specimens were received from institutions in the United States, Venezuela, England, and China.

The collection of negatives representing types and critical specimens now amounts to 4026 negatives, 75 having been added during the fiscal year. The current card catalogue of references to new species and other important literature and illustrations of woody plants was increased by 4642 items, the total now amounting to 125,819 cards.

Routine herbarium work has involved a further breaking down of the material in large genera into geographic sequences, at least a maintenance of the normal amount of mounting, although we are now far in arrears in this field, and the incorporation of many thousands of additional typed or clipped descriptions and illustrations into the herbarium. The crowded condition of the available herbarium cases, mentioned in previous reports, becomes more and more critical.

In connection with the general herbarium work various staff members have devoted much time to their special activities, with gratifying results. Professor Alfred Rehder completed his time-consuming task of seeing the second and thoroughly revised edition of his Manual of Cultivated Trees and Shrubs through the press. Dr. Johnston continued work on the very extensive Goodspeed collections of Chile, Peru and Argentine plants, identified the White and Shreve collections of Mexican plants, his own collection made in Mexico in the summer of 1938, and at the same time has reported on extensive collections submitted for identifi-

cation by his South American correspondents. He reported on nearly 600 specimens of Boraginaceae sent to him by numerous collectors for identification. Dr. H. M. Raup has made excellent progress on the study of his MacKenzie Mountains expedition plants collected in the past summer, and at the same time has identified and reported on important collections of Arctic and Saskatchewan plants submitted to him by various correspondents. He has also practically completed his report, in association with Mr. R. E. Carlson, on the land use history of the several tracts of land forming the Harvard Forest, the field work having been accomplished in the summer of 1938. This investigation was financed in part by the Arnold Arboretum, but mostly by a grant from the Harvard committee on research in the social sciences. Dr. Kobuski has continued his work on the Theaceae and on the genus *Jasminum*, while Dr. Allen has devoted much time to her studies on various large collections of Old World Lauraceae. Dr. Perry has continued her work on the identification of the extensive Richard Archbold Expedition collections of New Guinea plants. Dr. Croizat has devoted most of his time to a study of various genera of the Euphorbiaceae. Working under my general supervision, Miss Chen has completed a study of the eastern Asiatic species of *Ormosia*, and has initiated work on the peculiarly difficult genus *Sabia*. Such time as I have had available for herbarium work has been devoted to the study of various collections from China, the Philippines, Malaysia, Indo-China, and the 1938–39 collections of Captain F. Kingdon Ward on the Vernay-Cutting Expedition to Upper Burma. During the entire year Professor F. P. Metcalf of Lingnan University has occupied space in the herbarium working on the manuscript of his Flora of Fukien Province, and is the recipient of a Guggenheim Fellowship that enables him to remain a second year with the objective of completing this task.

Field Work. — The MacKenzie Mountains expedition of Dr. H. M. Raup during the summer of 1939 was eminently successful. On June 8, headquarters were established on Brintnell Lake, in the headwaters of the South Nahanni River, about 200 miles west of Fort Simpson. To reach their base involved several hundred miles of travel by airplane. The party remained at this base until August 20, when they returned to Fort Simpson, field work being continued there for about three weeks. Leaving Boston on May 20, 1939, Dr. Raup reached home on September 28. A total of 1665 numbers, about 14,340 specimens, were collected from this hitherto botanically unexplored area. The expedition was financed by grants from the Milton Fund of Harvard University, the

American Academy of Arts and Sciences, the National Academy of Sciences, the Arnold Arboretum, and generous donations from several individuals for this specific project.

Otherwise actual field work on behalf of the Arboretum has been done through the granting of modest subsidies to resident collectors and botanists, particularly in China. These include grants to the Fan Memorial Institute of Biology, Peiping, Sun Yatsen University, Hongkong, Lu Shan Arboretum, Likang, Yunnan, Nanking University, Lingnan University, National Szechuan University, and to Dr. A. Pételot, Hanoi, Indo-China. This cooperative work has been oustandingly successful in spite of continued and increasingly adverse unsettled conditions in China.

The Library. — At the end of the fiscal year the library comprised 44,506 bound volumes, several hundred unbound volumes, 12,726 pamphlets, 18,644 photographs, 3200 slides, and several thousand nursery catalogues. During the year there were added 383 volumes, 257 pamphlets, and 200 photographs. The A. B. Morse Company of Michigan made a generous gift of over 200 negatives and prints taken by the late Herbert W. Gleason mostly in the Arboretum, and 150 of them were selected and added to the collection of photographs. A fine series of photographs of New Guinea vegetation was presented by Mr. Richard Archbold of New York, to supplement the extensive botanical collections received from him last year. The cards added to the periodical and author catalogue numbered 1,200, among which were 300 containing bibliographical information, and 1406 slips were incorporated in the file which supplement the printed author and subject catalogues of the library. Nineteen new periodicals were acquired, most of them to continue as exchanges with our own publications. About 200 volumes have been loaned to other libraries, and some have been borrowed for use here. The demand for photostats continues and many books have been sent to the Harvard College Library for that work to be done. The holdings of the library have been checked up to the letter L for inclusion in the new edition of the Union List of Serials. A collection of about 300 books, left to the Plymouth Public Library some years ago by Benjamin M. Watson, Jr., formerly of the Bussey Institution, was purchased from that library, and was found to contain some rare and desirable items.

Atkins Institution of the Arnold Arboretum, Soledad, Cienfuegos, Cuba. — The plantings have been greatly extended, approximately thirty

acres of the tract transferred last year to the garden, having been developed through the replanting of the living material in the genera *Acacia, Bauhinia, Erythrina,* and *Ficus*. During the rainy period, July and August, many palms were transferred to the palm section, while the vine section has been re-arranged. To increase efficiency in handling young plants a nursery area has been developed, to which material is transferred from the propagating house. Further interplantings of desirable native trees have been made in the naturally wooded section, the entire area now being under easy control through the elimination of undesirable undergrowth. To help decrease the cost of maintaining the areas planted to trees and shrubs, a flock of forty sheep was acquired, and this innovation promises well in reducing the cost of controlling the growth of grass. The unusually cold winter season caused some damage to a few of the more tender species, but all of the damaged plants are recovering. The removal of the houses from Colonia Limones has proved to be a very excellent move from the standpoint of the garden, resulting in a cessation of damage by domestic animals and a great reduction in petty pilfering. As the cane fields surrounding the garden are turned into pasture, the fire hazards are correspondingly reduced. During the year, 516 packages of seeds, 369 living plants, and 54 lots of cuttings were received, and 404 packets of seeds and 94 lots of cuttings were distributed. About thirty individuals enjoyed the hospitality of Harvard House for shorter or longer periods of time. Graduate students at Harvard University working at the garden on various problems were Mr. C. T. Parson and G. E. Folk, Jr., while Dr. E. V. Watson, Commonwealth Fellow at Harvard, included the institution in his travels in connection with his ecological observations. The number of students listed for the next year is largely in excess of those in previous years. This increased attendance at the Atkins Institution is a reflex associated with the additional housing facilities now available in Casa Catalina, and greater ease of access due to the improved roads leading to Cienfuegos.

Publications. — The usual numbers of the Journal and of the Bulletin of Popular Information were issued. These official publications, however, reflect only in part the activities of the staff. A bibliography of the published writings of the staff and students working under the supervision of staff members is appended.

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E. D. Merrill, Director

Staff of the Arnold Arboretum, 1939–40

ELMER DREW MERRILL, S.D., LL.D., Arnold Professor of Botany and Director.

JOHN GEORGE JACK, Assistant Professor of Dendrology, Emeritus.

ALFRED REHDER, A.M., Associate Professor of Dendrology and Curator of the Herbarium.

JOSEPH HORACE FAULL, Ph.D., Professor of Forest Pathology.

IRVING WIDMER BAILEY, S.D., Professor of Plant Anatomy.

KARL SAX, Ph.D., Professor of Cytology.

IVAN MURRAY JOHNSTON, Ph.D., Associate Professor of Botany.

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ERNEST JESSE PALMER, Collector and Research Assistant.

CAROLINE KATHRYN ALLEN, Ph.D., Assistant in the Herbarium.

LILY M. PERRY, Ph.D., Technical Assistant.

LEON CROIZAT, J.D., Technical Assistant.

ETHELYN MARIA TUCKER, Librarian, to Dec. 31, 1939.

JANET RYTHER SELLARS, Librarian, from Jan. 1, 1940.

SUSAN DELANO MCKELVEY, Research Assistant.

CONSTANCE MANSFIELD GILMAN, Business Secretary.

LOUIS VICTOR SCHMITT, Superintendent.

WILLIAM HENRY JUDD, Propagator.

CORRECTIONS

Page 53, line 4 from below, for **dauricum** read **dauricus**

" 62, line 14 from below for *minutus* read *minutum*.

" 194, line 3 for *E. papuanum* read *P. papuanum*.

" 285, line 6 for *striata* read *striatum*.

" 385, line 14, for **numulariifolia** (G. Don) read **nummulariifolia** (D. Don).

" 385, line 16 for G. Don read D. Don

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Synonyms are printed in *italics;* new names in **bold-face** type.

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